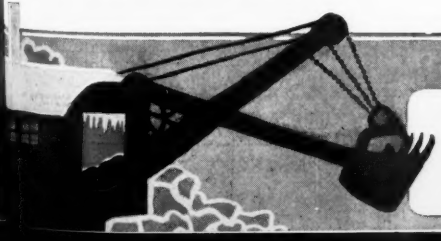
Pit and Quarry

SAND - GRAVEL - STONE
CEMENT - LIME - GYPSUM



December 1, 1925

Circulation 7,600

"Before I let you in—

"how many engines has your shovel?"

Do you remember how the one-engine steam shovel— with its "crowd" and "swing" drive through friction clutches— was "pushed off the map" years ago?

After the shovel buyer once tried the simpler and faster machine with three sets of direct-connected engines, he wouldn't even listen to the salesman offering a one-engine shovel.

No quarryman wanted the bother and expense of reversing friction clutches. Independent sets of crowding and swinging engines made every kind of digging go smoother and faster.

Direct control pays just as well today

An ERIE Shovel has no shafts, gears and clutches running idle most of the time, wearing fast and wasting power.

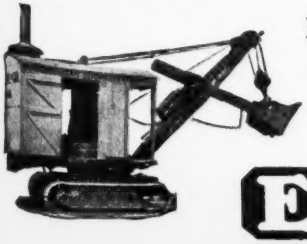
Three sets of direct-connected engines give INSTANT RESPONSE at the touch of throttle levers. The ERIE'S snappy action means money in your pocket.

Much harder digging can be done

When the ERIE hits big boulders, the operator doesn't "baby" the hoist to keep from killing the engine.

Instead, with the hoist throttle wide open he crowds the dipper in and out, to loosen the boulder— also swings, to pry sideways. Getting the full power of hoisting, crowding and swinging engines, all together. *The* ERIE'S *"crowd" and "swing" add more power, instead of stealing power from the hoist.*

Buy the shovel that *gets the work done.* Write us about the excavating you have to do, and we will tell you what ERIES are doing on similar work.



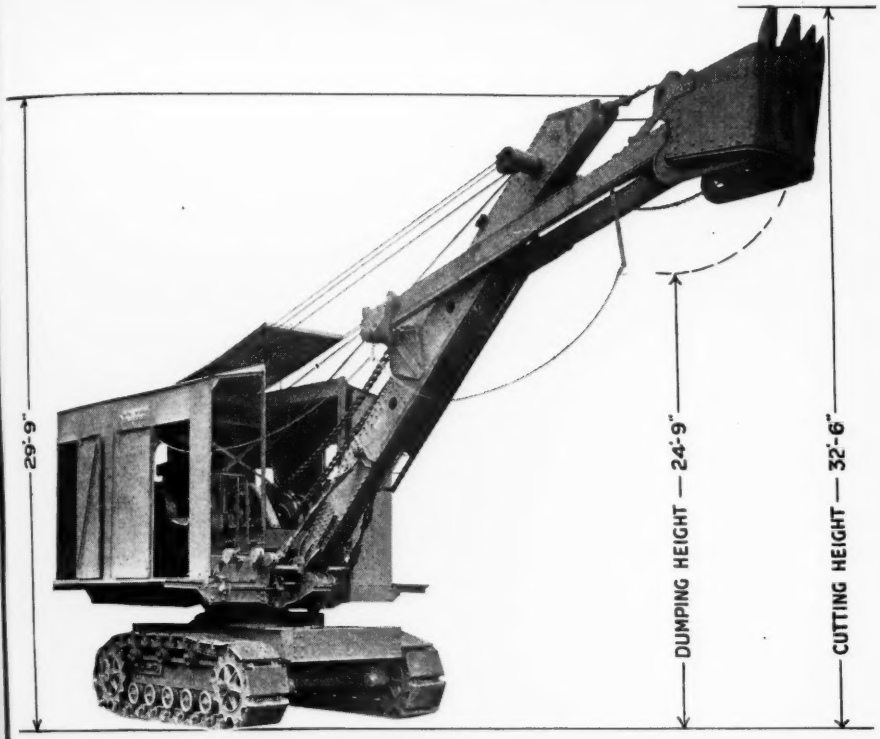
ERIE STEAM SHOVEL CO., Erie, Pa., U. S. A.

Builders of ERIE Shovels, Cranes, Ditchers, Draglines, Trench Hoes, etc.

Branch Offices: Boston, New York, Philadelphia Pittsburgh, Atlanta, Chicago

Representatives throughout the U. S. A.

ERIE Revolving Shovels



Compare These Cutting and Dumping Heights With Any Other Gasoline Shovel

The cutting height—32½ feet—of this P&H 1¼-yard Gasoline Shovel is of particular importance not only because of the value in digging up through the top of the bank—

But is still more remarkable due to the fact that this is not mere elevating height—but actual *cutting* height. The powerful crowding motion—an exclusive P&H feature — is effective above the horizontal position of the dipper, the teeth dig up and out with the full power of the motor and fly-wheel inertia back of them.

The high dumping position permits loading trucks on top of bank—saving time, labor and expense—and increasing excavating yardage.

HARNISCHFEGER CORPORATION
Established in 1884

Successors to

PAWLING & HARNISCHFEGER CO.
3851 National Ave., Milwaukee, Wis.

New York, Jacksonville, San Francisco, Minneapolis, Memphis, Philadelphia, Birmingham, Kansas City, Chicago, Los Angeles, Dallas, Pittsburgh, Detroit, Portland, Seattle

Warehouses and Service Stations: Philadelphia, Memphis, San Francisco, Los Angeles, Jacksonville, Seattle

P&H GASOLINE SHOVEL

Electric Drive—if it Pays in the Plant —it Pays in the Pit

Bucyrus Shovels, the small revolving shovels, the great new 120-B, and up to the big 320-B stripper, are built for electric power.

Wherever the shovel is a part of the permanent plant the electric shovel pays.

Wherever such a shovel is used only part of the time, the electric shovel pays in a greater ratio. It gives all the smooth, even power of steam, without the standby losses for idle time.

If it pays you to use electric motors in your plant, it will pay you to use electric shovels in your pit.

It costs nothing to investigate—send for the bulletin listed in the left hand column.

Bucyrus
Electric Small Revolving Shovels

20-B---¾-yard
30-B ---1-yard
50-B--1¾-yard

Send for Bulletin E-1002-A

Information on Steam, Diesel and Gasoline, also larger shovels, sent on request.

BUCYRUS COMPANY, South Milwaukee, Wisconsin

BUCYRUS

NEW YORK CHICAGO BIRMINGHAM SAN FRANCISCO PITTSBURGH TOKYO LONDON

708

300 to 400 yards of gravel

in 8 hours

The ORTON ½ yard Gas Shovel is just the machine for the small sand or gravel pit where the daily output is about 400 yards.

The Type "V" ½ yard SHOVEL has a maximum digging depth of 5′10″ below ground level; maximum reach of 24′0″ and dumps the dipper at 14′0″ from the ground. It makes 5 complete revolutions per minute.

Sand and gravel pit operators should know more about the ORTON ½ yard Shovel. We shall be glad to send you our new Bulletin 39 with complete specifications and price of the Type "V"—drop us a line today.

ORTON & STEINBRENNER CO.

Locomotive Cranes, Flexible Tread Cranes, Gantry Cranes, Truck Cranes.

608 So. Dearborn Street

CHICAGO, ILL.

Clamshell Buckets, Orange Peel Buckets, Rock Crushers, Power Shovels.

You Can Certainly Depend Upon A MASSILLON

Have you ever been in a pinch? Have you ever had to face the stark realization that your equipment is inadequate to the job? Every operator at sometime in his career has had this problem to face, when he suddenly realizes that imperfect equipment is costing him loss of time and money. That is when the operator thinks fast; that is when he instinctively turns to better, more dependable equipment. And when he has to have a strong, fast, economical shovel he will invariably choose a Massillon. We don't consider this peculiar, we understand that the experienced digger understands value.

THE RUSSELL & CO.

BUILDERS

MASSILLON, OHIO

The MODERN MASSILLON

Steam — 3/4 - 7/8 RANGE — Shovel

The Cleveland Forty-Four drilling in hard whinstone; McLaren & Company's quarry, Belford, Scotland.

WHEN THE THRIFTY SCOT BUYS DRILLS

The Scotch quarryman knows the game. And you can bank on it that he is going to buy drilling equipment to the best possible advantage. That's why the quarries of Scotland are buying and repeating on Cleveland Forty-Fours. They cost no more, and they greatly reduce the expense of drilling rock.

Bulletin 49 tells you all about the hard-hitting, easy-holding Cleveland Forty-Four.

The Cleveland Rock Drill Co.

3734 East 78th Street, CLEVELAND, OHIO

CHICAGO, ILL. 605 S. Dearborn St.	DETROIT, MICH. 428 Insurance Exchange Bldg.	PHILADELPHIA, PA. The Bourse Bldg.	BOSTON, MASS. 113 Pearl St.
NEW YORK CITY 30 Church St.	ST. LOUIS, MO. 2091 Railway Exchange Bldg.	BIRMINGHAM, ALA. 403 N. 24th St.	PITTSBURGH, PA. 922 Farmers Bank Bldg.
NEGAUNEE, MICH. 222 Heath St.		Box 2028	

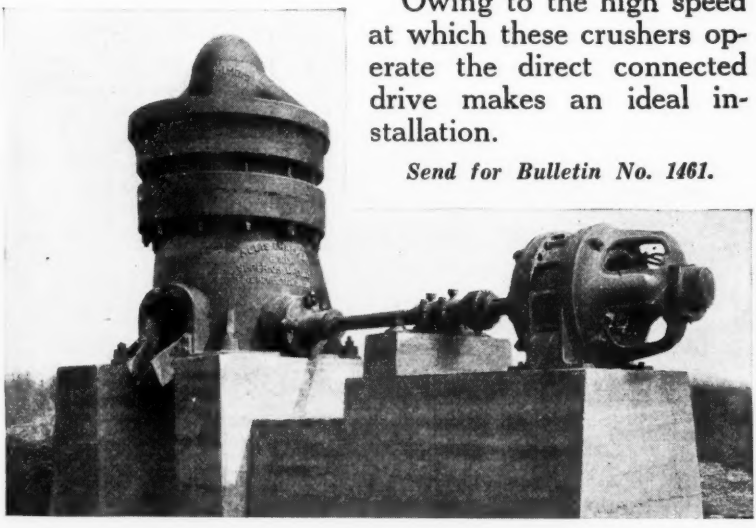
Canadian Trade Supplied by The Cleveland Pneumatic Tool Co. of Canada, Ltd., Toronto, Ontario.
British Representatives, John McDonald & Co., Pollokshaws, Glasgow, Scotland.
ASK YOUR OWN SUPPLY HOUSE FOR CLEVELAND DRILLS.

CLEVELAND ROCK DRILLS

Superior McCully Fine Reduction Gyratory Crusher

The most successful secondary gyratory crusher on the market today

Allis-Chalmers 6″ Superior McCully, Fine Reduction Gyratory Crusher direct connected to an Allis-Chalmers 50 H.P. type any slip ring motor @ 600 R. P. M. installed in the plant of the Hallock Sand Co., Columbus, Ohio.



Owing to the high speed at which these crushers operate the direct connected drive makes an ideal installation.

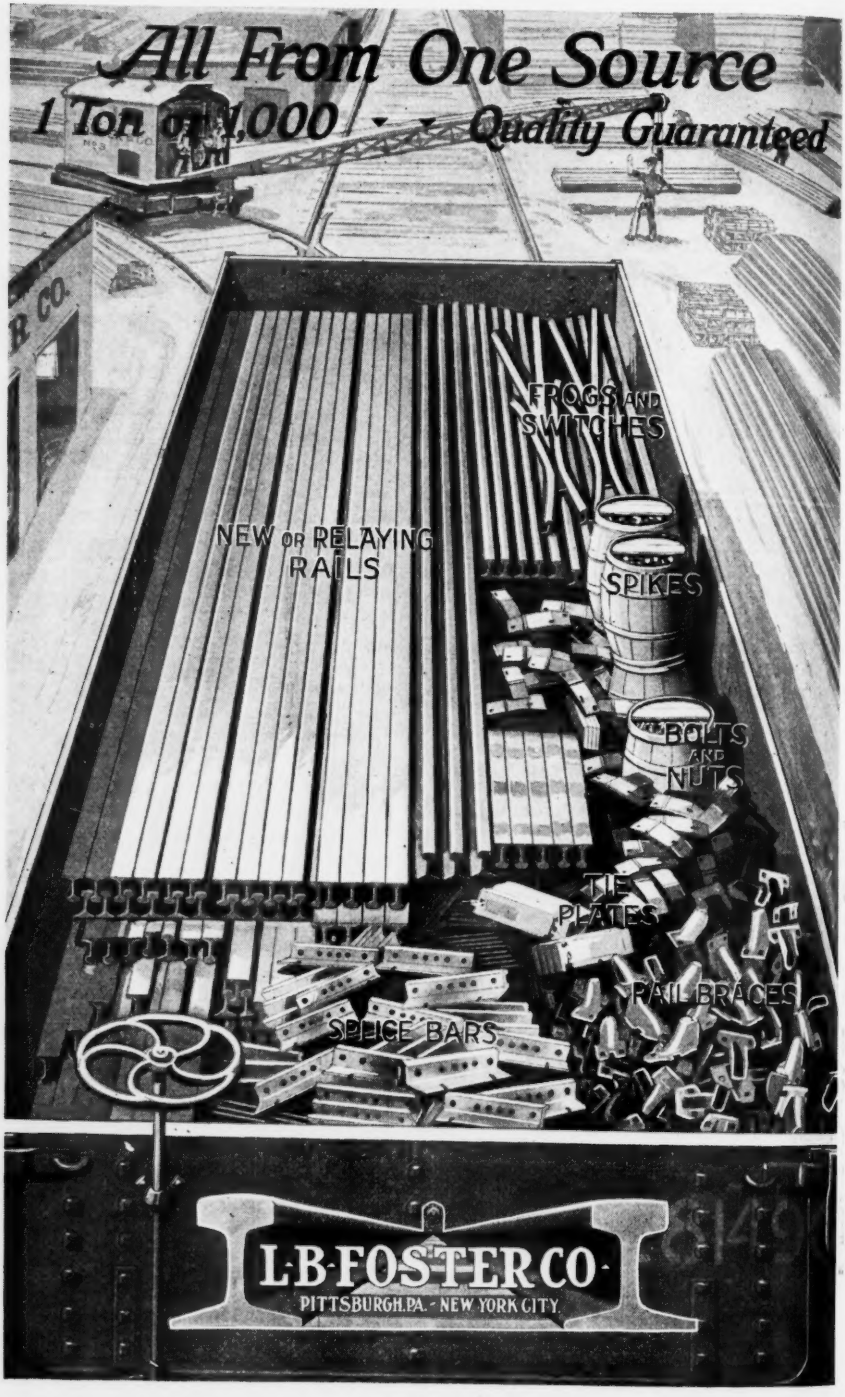
Send for Bulletin No. 1461.

Sizes, Capacities, Horse Power and Weights:

Size of Crusher in Inches	Two Feed Openings Size Each in Inches	CAPACITY PER HOUR IN TONS OF 2000 POUNDS — Size of Discharge Opening in Inches									DRIVING PULLEY		H. P. Required	Weight of Crusher in Lbs.
		¾	⅞	1	1¼	1½	1¾	2	2¼	2½	Size in Inches	R. P. M.		
6	6x40	24	28	32	40	48	...	...	...	...	36x12½	500	40 50	32000
10	10x52	...	...	...	...	80	94	107	120	135	36x18½	450	75 100	64000

ALLIS-CHALMERS

MILWAUKEE, WIS. U. S. A.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1 Ton or 1,000 - - Quality Guaranteed
FROGS AND SWITCHES
NEW OR RELAYING RAILS
SPIKES
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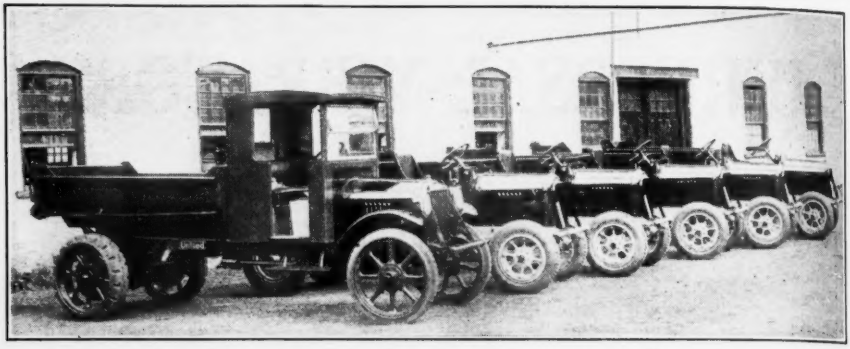

A fleet of United "Constructors" ready for delivery.

The United "Constructor"

Successful businesses use successful equipment.

It is a significant fact that United "Constructors" are practically all sold to organizations of the highest standing, concerns that are doing a profitable business and whose equipment is purchased only after thorough investigation.

Profits are made possible in contracting work only through the use of dependable and economical hauling equipment.

The United "Constructor" is designed and built to make your contracts profitable.

Write us for information.

UNITED MOTORS PRODUCTS COMPANY

Grand Rapids, Michigan

"Quality transportation units since 1910"

More and more rock products are being bought and sold by weight. Where loads are heavy and must be handled swiftly, the installation illustrated here is ideal. It consists of a Fairbanks Type "S" Auto Truck Scale, equipped with a dial which instantaneously shows the weight directly to the full capacity of the scale. 420 loads were weighed over this outfit in one 10-hour day.

Would you expect a wagon to stand an *auto truck load?*

Then why expect a *wagon* scale to stand *auto truck weighing?* If your wagon scale has given good service, it deserves an honorable discharge—before it fails under a load it was not *built* to stand.

With the coming of the auto truck, Fairbanks engineers foresaw the doom of the lighter "wagon scale" construction and immediately designed a truck scale ruggedly built to give lifetime service under the most trying conditions.

Basically, the problem was not new; for the extensive line of Fairbanks Scales had for years included Railway Track Scales and Grain Hopper Scales for weighing enormous loads. The time tested principle used in these scales has been adapted to the Fairbanks Type "S" Auto Truck Scale.

The result is a scale that will permanently "stand the gaff" of the motor truck—the impact on the platform, the concentrated load, the multiplied stress on the scale members. It is a scale that will *stay* accurate under this modern weighing condition.

The installation of one of these super-scales cannot fail to increase the confidence and goodwill of your trade. Moreover, it will probably pay for itself by eliminating the profit-dwarfing errors that cannot be avoided when a scale is taxed beyond its capacity.

One of our representatives would like to tell you more about the Type "S" Auto Truck Scale. Or mail the coupon below for an interesting booklet and Type "S" specifications.

FAIRBANKS SCALES

Preferred the  *World Over*

NEW YORK
Broome and Lafayette Sts.

CHICAGO
900 S. Wabash Ave.

And forty other principal cities in the United States
Coupon brings free booklet

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Fairbanks Scales, Dept. S-B-12
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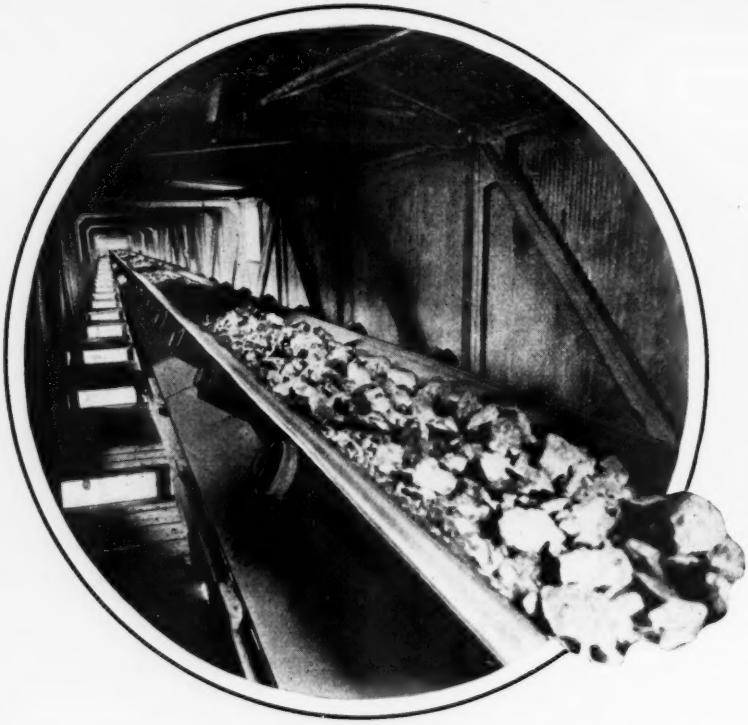
Please send copy of the Booklet "A Talk on Scales"; also Type "S" specifications.

Name .....

Address .....

Company .....



Handling Materials With Webster Belt Conveyors

Economical in both initial and operating expense, Webster belt conveyors offer a solution to many handling problems in the rock products industries. Well designed and ruggedly constructed, assures years of dependable, low cost service.

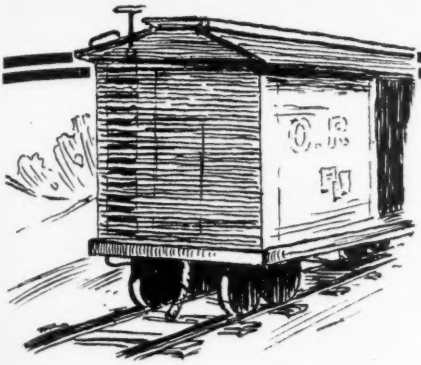
Manufactured in a wide range of capacities and in many different styles, with plain grease cup bearings or roller bearings.

Webster engineers are at your service to help you in your material handling problems. Consult them.

THE WEBSTER MFG. COMPANY

4500-4560 Cortland Street
CHICAGO

WEBSTER



The Dollars You Waste in Your Loading—

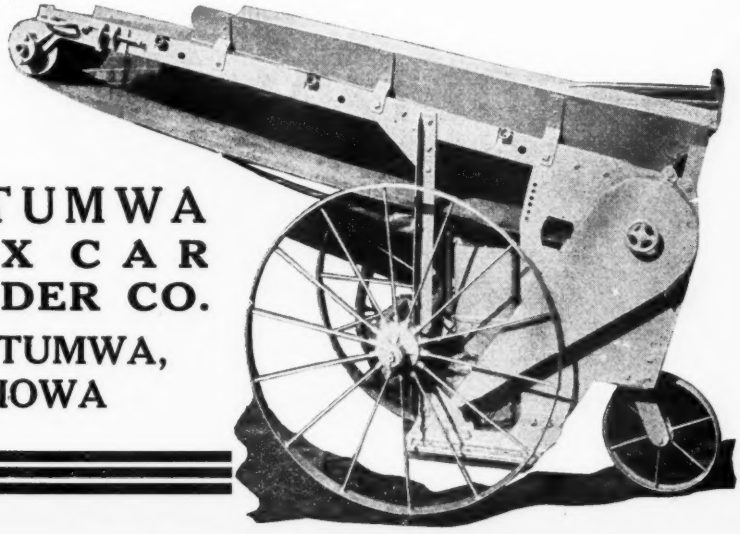
Save Them!

Dobbin, your old-time delivery agent of by-gone days used to slop many dollars worth of horse-power (oats) on the ground every time he ate. But somnolent, long-eared old Dobbin has long since been replaced by steam and electric horse power.

Why should you stick to Old-Dobbin loading methods, and spill nobody knows how many gold dollars on the ground every time you load a car! The Ottumwa Box Car Loader cuts out loss of time and money. Your business needs it.

The Ottumwa is manufactured with electric or gasoline power, has roller and ball bearings throughout and latest improved Alemite greasing system.

Let us send you information and prices.



OTTUMWA BOX CAR LOADER CO.

OTTUMWA, IOWA

Good News for Shovel Users

FOR some time past, in fact ever since Thew 1½ and ¾-yard shovels have been equipped with Center Drive Trucks, there has been a clamor from Thew one-yard shovel owners for Center Drives too.

Of course, it took time to make the change, but now it is done. Thew A1 one-yard shovels can now climb, steer and travel like Thew Type O Shovels.

"And that's going some," if you will take the word of every man who has bought a Thew Center Drive this year.

If you own a Thew A1, you don't have to buy a new shovel to get a Center Drive Truck. Yours can be equipped very easily. Ask us about it.

The above shovel belongs to I. F. Cavalluzzo, of New York. He ordered Thew Center Drives as soon as he got the good word.

If you are in the market for a new one-yard shovel, see a Center Drive perform before you buy. It will pay you.

THE THEW SHOVEL COMPANY, LORAIN, OHIO

Thew Shovels

Dig Faster—Last Longer

Pit and Quarry

Index to Advertisers

Vol. 11 CHICAGO, ILL., DECEMBER 1, 1925 No. 5

Pit and Quarry

A Semi-Monthly Publication for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime and Other Non-Metallic Minerals.

Vol. 11 CHICAGO, ILL., DECEMBER 1, 1925 No. 5

FEATURE CONTENTS

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Vice-Pres.

Secretary

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Rand-McNally Bldg., Chicago, Ill.

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Pit and Quarry

Vol. 11 Chicago, Ill., December 1, 1925 No. 5

Another Milestone of Progress

RECORDS of attendance at Portland Cement Association meetings were broken by the attendance at the annual meeting held at the Drake Hotel, Chicago, November 16 to 18, inclusive. More than 356 individuals representing 75 companies registered.

As usual, the first day's sessions were given over to the preparation of reports of Standing Committees for presentation at the general business session on Wednesday.

Tuesday was devoted to sessions for discussion of technical problems and mill practice relative to the manufacturing side of cement. The cement industry, as typified by the membership of the Portland Cement Association, has for a number of years been making notable records in the way of accident prevention. In June of this year, practically all of the member plants conducted a "No Accident" campaign, with the result that 72 of the 125 plants which entered the contest went through the month without a single time-lost accident. Certificates of merit were awarded to the plants having a clear record.

The regular business session and election of officers was held Wednesday, November 18. The following officers were reelected: President, Blaine S. Smith, General Sales Manager, Universal Portland Cement Co.; First Vice President, Lowell R. Burch, Vice President, Atlas Portland Cement Co.; Second Vice President, C. A. Irvin, Vice President, Alpha Portland Cement Co.; Treasurer, John W. Boardman, Vice President, Huron and Wyandotte Portland Cement Companies. In addition, the following were elected to the Board of Directors: John Treanor, H. Struckmann, L. C. Morton, H. F. Jennings, Charles Bootcher and William S. Speed.

In addressing the membership at the business session, President Smith called attention to the favorable outlook for the construction industry and presented a brief sumary of construction in 1925. Mr. Smith said: "Many cities have lagged behind in necessary facilities for sewage disposal, water filtration plants and other municipal and civic improvements having important connection with community health and welfare.

"With the financial recovery of the farmer an established fact, with general business conditions good, and with the need for municipal improvements and industrial enlargements, 1926 presents a favorable outlook for the construction industry.

"Awards for the first ten months of this year for concrete pavement are greater than for any twelve months on record. The equivalent of 5,752 miles of 18-foot road were completed and placed under traffic from January 1 to October 31, 1925.

"Only three years ago the Lincoln Highway Association completed a strip of pavement 40 feet wide near Dyer, Ind., which was heralded as the 'Ideal Section'. Many said that a 40-foot width of concrete would never be needed on our highways. Yet there will be completed this year a highway from Detroit to Pontiac, Mich., which, for its sixteen miles, has a total con-

crete paved width of 88 feet consisting of two separate lanes each 44 feet wide, one for northbound and one for southbound traffic. Again, Wayne County (Detroit) Mich., has established as its fixed policy an ultimate minimum width of 40 feet of concrete on its entire 440-mile system of County roads.

"The need for more roads and wider roads is indicated by the fact that over 17,000,000 of the 19,500,00 cars in the world are in the United States. Estimating 1925 U. S. production of new vehicles at 3,800,000, the space merely to store these cars would require 4,318 miles of 18-foot road. To keep them moving requires much more, so that the 5,752 miles of concrete roads built in 1925 are not nearly sufficient to accommodate the growing motor traffic.

"In the cement industry, the year has been marked as one of ample supply of cement.

"Although shipments for 1925 will doubtless exceed those of last year, stocks have consistently been higher than in 1924. The explanation lies in the large increase in cement manufacturing capacity made during recent years, which have brought productive capacity up to an estimated total of more than 185,000,000 barrels a year, or some 25 per cent in excess of the largest year's demand."

At the conclusion of the business session about 250 of those in attendance took busses from the Drake to the site of the Association's new building, Grand Avenue and Dearborn Street, to participate in the corner stone laying ceremony.

The principal address was by Robert W. Losley, of Philadelphia. Mr. Losley was one of the organizers of the Portland Cement Association and its first President. He is now an honorary member of the Association.

Other addresses were made by Blaine S. Smith, President of the Association, and by B. F. Affiock, President, Universal Portland Cement Co., and Chairman of the Association's Building Committee.

The corner stone laying marked the culmination of several years of planning on the part of the Association toward the end of owning and occupying its own home.

Year by year the activities of the Association have grown, until the service demands made upon it by engineers, architects, contractors and users of cement in general have resulted in a personnel of more than 400 employes, devoted to improving and extending the uses of concrete. The Association has 30 District Offices conveniently located in principal centers over the country, so that immediate cement-user service is available practically everywhere.

The new building was designed by Holabird and Roche and is being erected by the Turner Construction Co. of Chicago and New York. Its five stories and basement provide quarters for the Association's research laboratory and general offices. For the past ten years the laboratory has been located in the Lewis Institute, Madison and Robey Streets, and conducted co-operatively with the Institute. But the laboratory work also has grown rapidly in importance and has steadily outgrown the accommodations which the Institute could provide.

Many interesting and advanced features are to be incorporated in the Associations new home. Naturally the building is concrete throughout, except for the steel used for reinforcement. Concrete is being proportioned, mixed and placed after scientific methods of control, to insure uniformly high quality. The result will be a structure possessing the maximum of utility and economy obtainable. The exterior will be Benedict Stone, as will be much of the interior detail. Concrete art marble will be used freely.

A banquet winding up the three-days' sessions was held at the Drake Wednesday evening. One of the speakers was United States Senator Arthur Capper, nationally known as a publisher of many farm papers and the Topeka Capital. Senator Capper spoke on "The Farmers' Yesterday and Tomorrow."

Another speaker was John J. Earley, well known architectural sculptor of Washington, D. C. Mr. Earley's talk was on "The Concrete of the Artist and of the Architect."

One of the most outstanding examples of Mr. Earley's work is at the entrance to Washington Park, Chicago. This is the statue of the Fountain of Time, conceived and designed by Lorado Taft, and executed in concrete by Mr. Earley. Another mounmental work of Mr. Earley's is the interior of the Church of the Sacred Heart in Washington, of which there exists no finer example of the color possibilities of concrete.

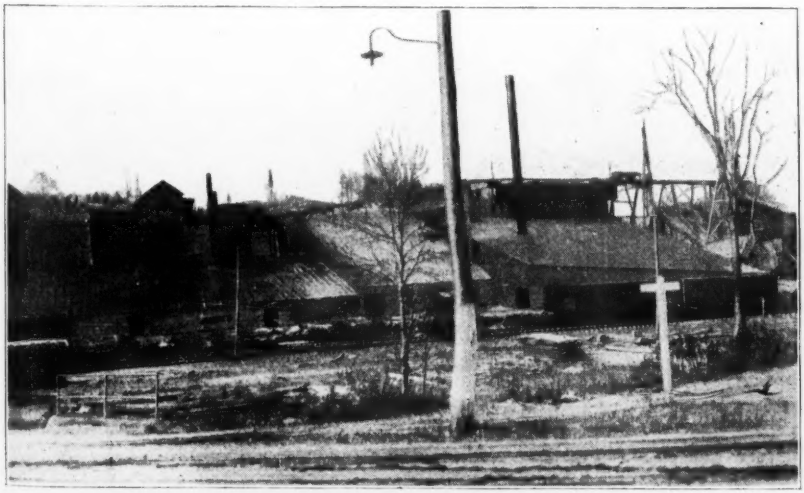
Technical Skill and Good Management Factors in Canadian Lime Plant

By F. A. Westbrook

GOOD management and technical skill of a very high order are evident in the operations of the Dominion Lime Company at Lime Ridge, Quebec, Canada. This company conducts one of the most important operations of its kind in Canada. Not only is the output large and the variety of products marketed greater than in the average lime plant, but the methods employed are thoroughly efficient. The different products are being manufactured in harmony with the general scheme of economy with a result that the Dominion Lime Company has secured a good distribution of overhead and operating expenses with commensurate profit making possibilities. The products are lump lime, finishing hydrate, mason's hydrate, back wall plaster and agricultural lime.

The burning of lime in this plant was originally accomplished in wood kilns, and there are five of them still in use. Some years ago a wood chemical company, operating in the neighborhood, sent up the price of desirable cord wood to such a figure as to make it impossible to use it for lime burning. The result was that the company installed five gas kilns served by a Bradley gas producer. Later on, when the chemical company gave up business and the price of wood went down, the gas kilns were discontinued for a while, but at the present time the market is such that practically the full capacity of both wood and gas kilns is required.

The question which naturally first arises in the mind of anyone interested in the making of lime is, How does the gas producer work? The answer is that it works very well indeed, but that there is a certain technique of handling both the producer and the associated kilns which must be learned or there will be trouble. Mr. Parker, the young assistant superintendent, has made a specialty of this and has met with great success. Here is how he has done it. When it was decided to start up the gas kilns again, Mr. Parker visited several plants where this method of burning was employed, among them the Swanton Lime Works, owned by Mr. John Rick of St. Albans, Vermont, described in the November 1st number of Pit and Quarry. Mr. Parker found that wherever intelligent, practical men were handling this kind of plant, there was no trouble; but that, nevertheless, it is a different proposition from wood or coal firing.



The Wood Kilns, Hydrating Plant, Gas Kilns and the Pulverizing Plant.

Face of Quarry 195 Feet High

Mr. Parker describes his method of handling the gas burning as follows: Close watch must be kept over both the producer and the kilns. Trouble usually first appears at the producer. The color of the smoke in the producer as seen through the poke holes should be bluish green. As soon as it looks black, the fire should be poked. This breaks up the bed and prevents the formation of coke and keeps the fire clean as well. More coal is then added, the amount depending on the color of the smoke and the back pressure. A poke hole is opened every once in a while to see if the back pressure, or pressure of the gas in the producer, is all right. This is indicated by a hissing sound, and the operator can tell by the character of the hissing whether conditions within the producer are as they should be. This knowledge, of course, results after a certain amount of experience. If these adjustments are proper, the fire will be cool and the consumption of coal will be a minimum.

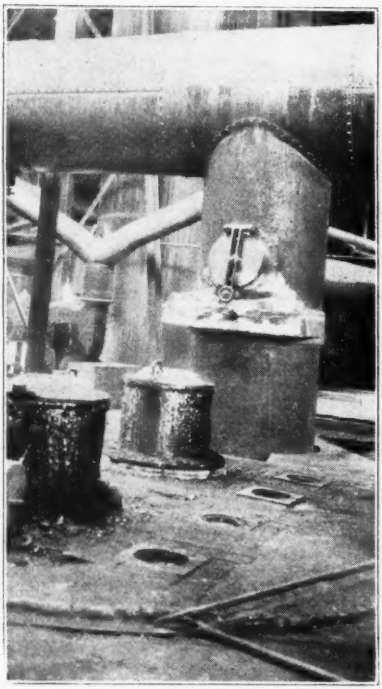
When the back pressure and fire in the producer have been properly regulated, the kilns are examined and either more or less gas turned on. If flames and smoke shoot out of the poke holes at the kilns when they are opened, it means that there is too much gas. The first thing to do under such circumstances is to close up on the gas valves in order to secure complete combustion in the kiln; in other words, this adjusts the relative quantities of air and gas to form a perfect mixture for consumption, just as it is necessary to secure a proper mixture of air and vaporized gasoline from the carburetor of an automobile to obtain complete explosion, or combustion, in the cylinder of the engine. Another practical detail to

Incline from Quarry to Trestle Passing Over the Tops of the Kilns

watch for through the poke holes is whether the heat in the kiln is uniform on all sides. If it is not uniform, it is not a difficult matter to adjust the flames so as to direct them in the desired direction by manipulation of the valves. It is also axiomatic that to obtain the best results, the kilns must be full.

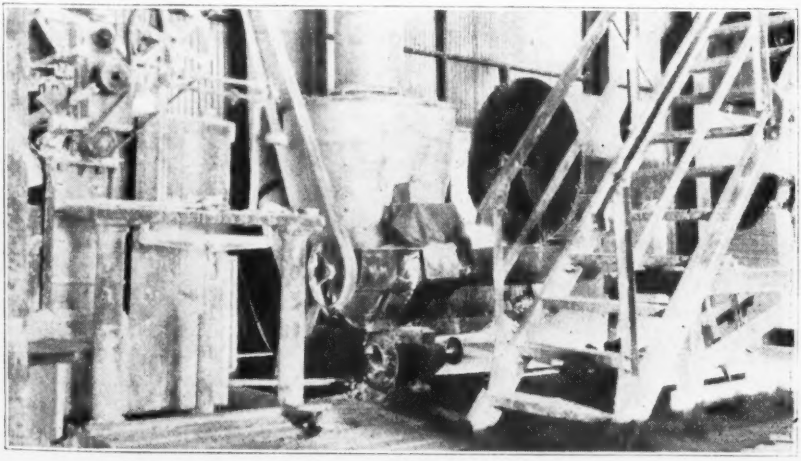
From the standpoint of the producer one of the greatest causes of trouble is dirty fires. They should be cleaned thoroughly at least once a day and to such a degree that six inches of clear fire is left on the grates. It is necessary also to have a number of long pokers at hand so that as soon as one gets so hot that it becomes soft another can be used in its place. Mr. Parker has introduced a very important innovation in the operation of the producer. It is the use of water and compressed air instead of steam.

This is managed by disconnecting the steam pipe and bringing an air line up to the opening of the old steam connection. As the blast of air enters this opening, a small stream, or rather trickle, of water is allowed to run in at the same time. The latter is taken up by the air current and carried into the fire. It does not seem to be necessary to regulate the amount of water very closely, but too much air makes the fire too hot. The particular trick in regard to the air control is to partly block up the opening into the old steam pipe so that the compressed air will not draw in too much additional air from the surrounding atmosphere. Experience and intelligent observation soon point the way to adjustment in this respect. The important point to remember is that too much air makes the fire too hot and causes the formation of clinkers.

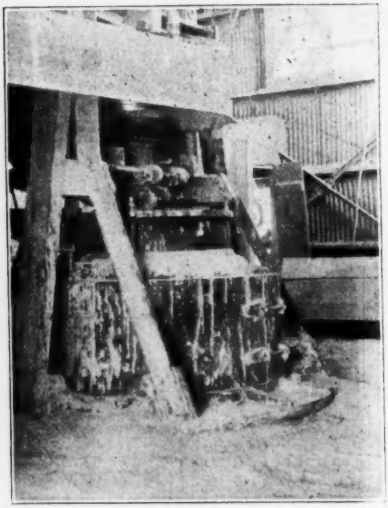


Firing Platform of the Gas Producer

Mr. Parker has certainly demonstrated the efficiency of his manage-



Raymond Mill at End of Cooler in the Hydrating Plant



One of the Bradley Mills in the Pulverizing Department

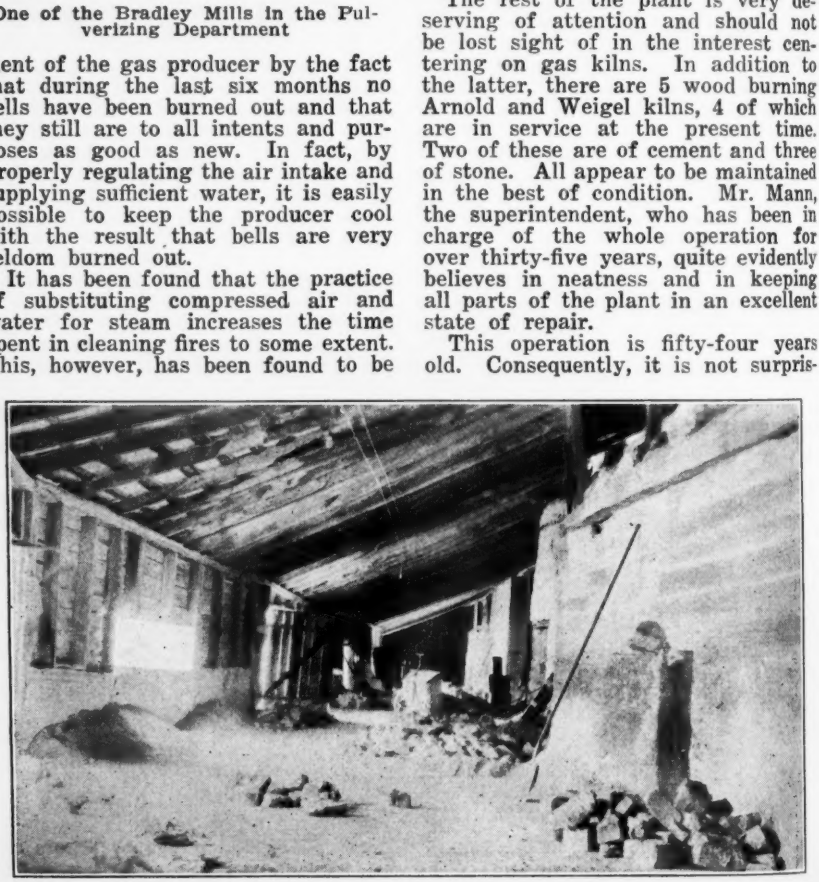
ment of the gas producer by the fact that during the last six months no bells have been burned out and that they still are to all intents and purposes as good as new. In fact, by properly regulating the air intake and supplying sufficient water, it is easily possible to keep the producer cool with the result that bells are very seldom burned out.

It has been found that the practice of substituting compressed air and water for steam increases the time spent in cleaning fires to some extent. This, however, has been found to be well worth while because of the very important savings in coal thus secured. Formerly it was necessary to run a separate boiler to make steam solely for the producer. This not only consumed a good deal of coal but required attendance. Furthermore, coal in Canada is very expensive. This method of economy fits in very nicely because there is adequate compressed air available, and there is practically no extra charge necessary for it.

With three of the gas kilns running, the coal consumption in the producer is between 7½ and 8 tons in 24 hours with a production of something like 40 tons of lime. Seventy-five per cent gas coal is used. Two men, working on 8 hour shifts, are capable of caring for the whole gas plant, producer and kilns, whereas the wood burning kilns require double that number of men.

The rest of the plant is very deserving of attention and should not be lost sight of in the interest centering on gas kilns. In addition to the latter, there are 5 wood burning Arnold and Weigel kilns, 4 of which are in service at the present time. Two of these are of cement and three of stone. All appear to be maintained in the best of condition. Mr. Mann, the superintendent, who has been in charge of the whole operation for over thirty-five years, quite evidently believes in neatness and in keeping all parts of the plant in an excellent state of repair.

This operation is fifty-four years old. Consequently, it is not surpris-



Drawing Floor at the Wood Kilns

ing that the face of the quarry is 195 feet. It will be possible to go 50 feet deeper before it will be necessary to move in another direction. The development of labor saving arrangements and material handling has, of course, been carried to a high degree and is suggestive of what can be done under intelligent management.

It will be seen that, in addition to the kilns, there is a Clyde hydrating plant with a Raymond mill, Sturtevant crusher and Jeffrey conveyors, and a pulverizing plant with Jeffrey conveyors, a Jeffrey crusher, a Bradley three roll mill and a Bates valve packer manufactured by the Valve Bag Company of America. There is a cableway as well as an incline for bringing material up from the quarry and a series of tracks on trestles for distributing it to both kinds of kilns from both cableway and incline. Chips and other stone unsuitable for the kilns are taken to the pulverizing plant in the same way, and it will be seen that the tracks, cableway and incline are so arranged that complete flexibility of movement is obtained. That is, cars loaded in the quarry and ascending the incline or cars loaded from the cableway may be taken to any of the kilns, the dump, etc. The tracks in the bottom of the quarry, of course, center at the foot of the incline. Skips operating on the cableway may, of course, be loaded at any convenient place.

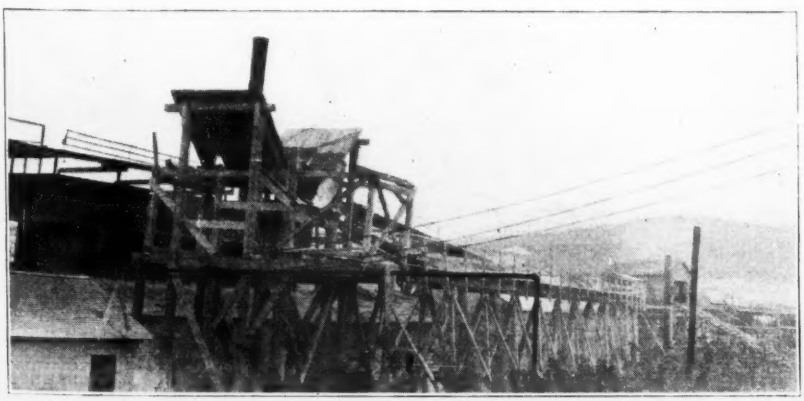
The incline is operated by a 15 h.p. motor driving an old hoist, and the cableway is operated by an air hoist. There is also a Cameron volute pump of 200 gallons capacity, driven by an 18 h.p. motor, which keeps down the water level in the pumps. The guy derrick is an old one, still operated by steam.

Lower Drawing Floor of the Gas Kilns.

Drilling is done by means of Ingersoll Rand jackhammers. Holes are drilled about 10-12 feet apart, 5 or 6 feet back and about 8 feet deep. Forty per cent dynamite, cxL Canadian explosives, is used for blasting. For secondary blasting holes are drilled only about 2 inches deep and are charged with 1 inch of the same explosive.

The hydrating plant is located between the wood kilns and the gas kilns, which is the logical place for it, as lime to be hydrated may thus easily be taken to it from either direction.

The opening of the Sturtevant gy-



Trestle Over Kilns and Incline From Quarry

ratory crusher is in the floor which is on a level with the lime drawing floors of both sets of kilns. After the lime is dumped in here, it is not handled again until it is loaded onto freight cars from the Bates valve bagger. This plant was erected by H. Miscampbell and Company.

The pulverizing plant, located at the extreme end of the whole plant, was mostly installed by the Jeffrey Manufacturing Company who also built the conveyors, elevators and crushers. The product is pulverized limestone for agricultural purposes. The pulverized limestone and hydrated products are, as indicated in the diagrams, shipped in bags. Lump lime, which is largely used for paper making, is shipped in bulk or in steel barrels.

Taking a bird's-eye view of this whole operation over which Mr. Mann has supervision, it will be seen that not only are the operating methods up-to-date and efficient and the plant well kept up, but that the physical arrangement is carefully planned.

Water Softening

The National Lime Association has issued an interesting bulletin entitled, "Water Softening." This bulletin is 6x9 inches in size and contains 48 pages of extremely valuable information. It is easily read and well illustrated. The treatment of the subject is non-technical as far as possible and will be of value to those who have anything to do with water treatment. There are four main chapters each relating to a particular phase of water softening or treatment. These chapters have been prepared by authorities. The first chapter, "Advantages of Use of Lime in Water Treatment," is by C. P. Hoover of Columbus, Ohio. The second, "The Cost of Impurities in Locomotive Water Supply and Value of Water Treatment," is from the report of the Water Service Committee of the American Railway Engineering Association. The third chapter, "Raw Water Ice," presents valuable information in unusually interesting style. The last chapter was prepared by C. Arthur Brown on "Some Variants from Accepted Formulae in Water Flows."

Best Concrete & Cement Co., Cleveland, Ohio. Capital, $5,000. Incorporator, Mr. Louis M. Levin.

Georgia and Alabama Clays

The results of a study of the utilization of Georgia and Alabama clays as mineral fillers, recently completed by the Bureau of Mines, Department of Commerce, indicate that these clays, when prepared properly, can be used advantageously in the manufacture of paper, wall paper, rubber, paint, oilcloth, textiles, kalsomine, plaster, matches, and numerous other materials.

The white clays or kaolins of Georgia and, to a small extent, of Alabama, have been utilized in the ceramic industry for many years, according to W. M. Weigel, mineral technologist, in a report just published. Some of these deposits have supplied clay to paper manufacturers and a very few have produced clay for use in rubber compounding and the manufacture of oilcloth and paint. As many owners and operators of clay deposits are unfamiliar with the different requirements for clays to be used as fillers, and so are unable to prepare their product for the market to which it is best adapted, the Bureau of Mines, in its endeavor to increase efficiency and economy in the mineral industries, has studied the clays in question to ascertain the uses to which they could be most efficiently put. A study of the Georgia clays for ceramic use was the subject of an earlier investigation by the Bureau.

The general area in which occur the clay deposits studied by the Bureau of Mines extends as a belt across middle Georgia, into Alabama, and up to the northern end of the boundary between Alabama and Mississippi. This area is part of the coastal plain region. The Georgia clays were evidently derived from the decomposition of the crystalline rocks of the Piedmont Plateau to the north, and some of the Alabama clays are from similar rocks to the northeast.

The clay beds range in thickness from those too thin to work profitably, up to more than 40 feet. The thickness of cover ranges from a few inches up to depths that make stripping impracticable. At some places 50 to 60 feet of cover has been stripped to expose the clay.

The results of this investigation are given in Technical Paper 343, "Georgia and Alabama Clays as Fillers," copies of which may be obtained from the Bureau of Mines, Department of Commerce, Washington, D. C.

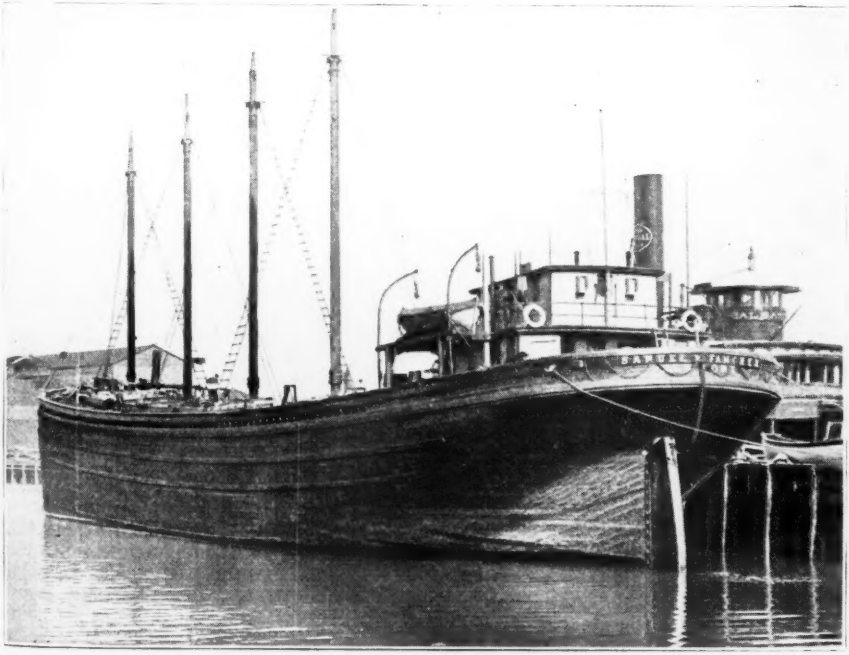
The U. S. Gypsum Solves a Problem

TRANSPORT conditions are a major factor in the building-situation in Florida, and the United States Gypsum Company has resorted to extraordinary methods to meet them. Since mid-summer railroad embargoes have prevented the shipment of building supplies into the state. As a result, construction, even in the largest centers, has been held up or has been proceeding on a hand-to-mouth basis, depending on small lots of materials available. Progress on hotels, large blocks of residences, apartment houses and structures of other types has been delayed. In the smaller communities building has been almost at a stand-still. Houses with the framework up but without roofs, houses completely enclosed and lathed but unplastered, houses in every state of partial completion, stand idle from lack of the materials necessary to finish them.

Another consequence of the congestion of railroad traffic is that the building supply trade is operating under most difficult conditions. Many dealers, especially in smaller towns, have done a moderate volume of business during the several lean years preceding the present heightened activity, but, now that the market has obtained a demand that would make good profits possible, these dealers have been unable to take advantage of the condition through lack of stocks to sell.

"I never saw such clean yards in my life," one observer recently stated. "In a trip through the State I went into yard after yard in which there literally was not a stick to be sold. It is not exaggerating in the slightest to say that many building supply dealers have closed their offices and have gone fishing."

Students of the situation agree that this lack of materials is one factor which seriously threatens the entire Florida situation. Observers disagree violently, of course, as to whether or not Florida real estate is a sound permanent investment; but all are agreed that the building industry of the State would enjoy an extraordi-



A 3,000 Ton Ocean Barge Put Into Service Between New York and Florida

narily profitable season if supplies were available which would permit construction to proceed.

To relieve this situation, at least insofar as gypsum building materials are concerned, the United States Gypsum Company is shipping plaster, lime, stucco, wallboard and other commodities by sea from New York City and New Orleans.

This service was started in September, when the steamship Gaston, owned by the Southgate Marine Corporation of Norfolk, Va., was chartered to make two trips a month between New Orleans and Miami, carrying 1,000-ton cargoes of plasters and wallboard which were shipped to the loading docks from the company's plants at Sweetwater, Texas, and Southard and Eldorado, Oklahoma.

These supplies were absorbed rapidly. So the sea-going tug, "Gypsum King," towing the 3,000-ton ocean barge, "F. W. Fancher," both owned by the United States Gypsum Company, were put into service between New York and Florida. The first cargo consisted of gypsum cement, moulding and gauging plasters from the company's plant on Staten Island, hydrated finishing lime from Genoa, Ohio, Sheetrock wallboard and Rocklath from Oakfield, New York; besides Oriental Stucco from Staten Island and Textone and Sheetrock finisher from Gypsum, Ohio—a total of approximately 3,000 tons. It was estimated that this load contained sufficient materials to finish 2,000,000 square feet of wall and ceiling space.

This initial cargo, which was taken on at Staten Island and at Weehawken, New Jersey, was distributed to Miami, St. Petersburg, Tampa, Key West and Jacksonville. A portion of the supply reached interior points in the state.

Following discharge of this cargo, the Gypsum King and the Fancher proceeded to New Orleans, where they joined the twice-a-month service instituted by the Gaston. In this way, seven of the company's properties located in four Northern and Western States were enlisted in the effort to relieve the Florida building congestion. It is expected that this service will continue throughout the winter or as long as may be needful to bring the situation back to normal.

Handling Material at High Temperatures

The Handling of highly heated material by means of conveying equipment embodies special conditions which do not ordinarily have to be taken into consideration. For this reason, the screw-conveyor installation recently completed by The Stearns Conveyor Company, Cleveland, Ohio, for the Standard Portland Company at their plant at Painesville, Ohio, is of interest.

The material handled is hot cement clinker at a temperature of 1500 degrees fahrenheit. The clinkers are discharged from the kiln directly into the four Stearns screw conveyors shown in the accompanying illustration in parallel with each other. Three of these screw-conveyors are 60 feet long, and the fourth is 65 feet long. These four parallel conveyors discharge into a cross-conveyor which runs at right angles to them. This cross screw-conveyor carries the clinkers to a centrifugal pump which in turn delivers it to the coolers.

All five conveyors are driven from the same motor; the cross-conveyor by means of a speed reducer and chain, and the four parallel conveyors from countershafts through bevel gears. Each parallel conveyor is equipped with a jaw-clutch cast integral with its bevel gear so as to permit it to be cut in and out independently of the others.

The cross-conveyor runs in a concrete trough built into the floor. This makes it possible to anchor the countershaft, and by making the bearings of the parallel screw-conveyors integral with those of the countershaft the drive ends of the parallel conveyors are also anchored firmly in alignment. The parallel conveyor-troughs are made from $\frac{3}{16}$ inch steel plate. All conveyor screws 10 inches in diameter and $\frac{3}{8}$ inches in thickness, and are made from steel plates. The feet of the troughs are made from cast-iron riveted to the troughs and set on $\frac{1}{2}$ inch thick steel plates. These plates are anchored to concrete piers, and their ends are bolted to cast-iron guides which allow the trough to slide and yet to maintain perfect alignment. In order to allow for the heat-expansion of the screw, the screw itself is cut back 3 inches from the hangers; the total amount of expansion arranged for being $2\frac{1}{2}$ inches on the troughs and 5 inches on the screw.

Economics of Drilling Operations

By R. N. Van Winkle

DRILLING operations in quarry and open pit mining are carried on by the churn drill method, by some mechanical means such as air or steam operated tripod drills, jack hammer or plug drills or drills of the piston type, or by steam, electric or gasoline drive churn type of well drill. Doubtless all of these methods of drilling are applicable and successful under proper conditions; at the same time each method has its limitations, since drilling must be accomplished in the best, cheapest and quickest way possible.

The elements of drilling and blasting are so interlaced and bear on one another to such a degree that a separate or individual treatment is almost impossible. Reference will, therefore, be made throughout to explosives and blasting. It will be found that it does not cost a penny more to see that drill holes are properly drilled and correctly placed, and if this is conscientiously done, a great saving in explosive cost will result. It is also just as important to see that the correct diameter of hole is worked out in the beginning in the average operation, as the spacing and placing; for in some instances the hole should be of large diameter to allow the explosive to be placed in the bottom, while in other operations holes of smaller diameter should be used to allow the explosive to extend well up in the hole. Too much stress cannot be given to the very important operation of drilling in quarry and open pit mining. If there is one general criticism which can be made at the beginning of the average operation, it is that too often drill holes are spaced too far apart. It is not as serious an error to set holes a few feet farther back, but if close attention is given to spacing of holes and they are not located in a haphazard way, far better results will be attained. In the majority of operations proper initial fragmentation of the ground or rock is the ideal condition for which we are striving. The degree of fragmentation depends greatly on the distance between drill holes. If holes are properly drilled, correctly spaced, a reasonable blasting cost will result.

While tripod drills are used, the churn drill or well drill type has supplanted them to a great extent in some quarries for horizontal drilling, inclined drilling, or snake holding, and vertical drilling in benching operations. By the use of well drills it is often possible where benching methods have been followed to throw numerous small benches into one, and by so doing the upper benches or strata will require no explosive to produce properly fragmented material for the first 10 to 15 feet in depth. If worked in benches this would require drilling, blasting and moving, and the duplication of the same operations again on each bench. Due to various reasons with which we are all familiar, secondary drilling is in most instances performed by what we call jack hammer or plugs drills, which are held with the hands without a tripod and are therefore rapidly moved from one location to another. Special extra heavy drills of this general type, that is piston type, sometimes called hammer drills, are being manufactured and used for drilling vertical holes 12 to 15 feet in depth, and, it is claimed, to a depth of 30 feet in some instances.

The first question to come up, when piston type and churn drill types of drilling are contrasted or compared, is the debatable problem of small diameter versus large diameter drill holes. Unquestionably, small diameter drill holes ranging in size from 1 to 1¼ inches can be drilled faster and cheaper than 4 to 6 inch diameter holes which are drilled by well or churn drill equipment. Some operators claim that the ease with which small diameter holes can be drilled more than compensates for the restricted size of the hole. In the writter's opinion the only reason for drilling is to displace rock or ground so that sufficient amounts of explosives can be properly and effectively placed for fragmentation. It will be found that the piston type of drill will of necessity have to drill from 2 to 9 times as fast to maintain the same loading ratio of hole capacity for explosives. The volume of drill holes of various sizes varies as the square of the diameter. Therefore, a 6 inch churn drill or well drill hole of a given depth has nine times the volume of a 2 inch hole of the same depth, provided no springing has been done. To state

this in another way, the purpose of drilling is to obtain space for explosives. Consequently, the only fair method of comparing costs is to consider drilling, not in terms of cost per foot, but rather on the basis of volume of space obtained. It is an admitted fact that the actual operation costs based on per foot of hole drilled is possibly 50 to 100 per cent cheaper when using piston type drills and small diameter holes. The thing to be attained is low cost of broken material thrown down on the loading floor properly fragmentated for successful handling. Footage drilled is not the governing factor. Diameter of hole and capacity of hole for explosives has greater influence on the final cost of fragmentated material; for the larger the diameter of cartridges used, the greater is the efficiency, the greater the safety, and the less the deterioration of explosives.

The writer is not convinced that small diameter holes are economy. Where the ground is not too hard and stratification and cleavage lines will permit, drilling over 15 feet in depth is ultimately cheaper per ton or per cubic yard of ground or rock shot when the churn or well drill method is used. There is merit in drilling small diameter holes between well drill holes in bank shooting to assist in breaking up heavy top layers or strata, and the piston type drill will doubtless always be used in some benching operations and in snake holing. In fact, certain methods and attacks of drilling which are successful in one operation will not necessarily serve in another operation even when the two operations are apparently identical.

There is a proper balance which must be found between drilling costs and actual explosive costs. For instance, an extremely hard rock proposition where drilling is expensive, something like trap rock or granite where the ground is not only hard but extremely abrasive, will require an explosive of very high strength. Drill hole spacings must be widened out as far as possible to economize in drilling, owing to its expense; and to compensate for the greater spacing of drill holes a higher strength explosive is used and larger diameter drill holes. In attacking trap rock it has often been found highly essential to use holes as great as 8 inches in diameter. The reverse is true in softer materials, where drilling costs are low proportionately. It is then more economical to use closer spacing of drill holes and lower strength explosives. This is what is meant by proper balance between drilling and explosives and should not be looked upon too lightly. Each drill hole can be called upon to displace so much material, depending, of course, on the diameter of hole and quality and condition of ground. In large bank shots it is possible to figure the number of tons of ground shot or fragmentated per foot of drill or bore hole used in the shot. While this varies greatly, it is a means of checking up and assists in finding a balance between drilling and explosive costs. The tons of stone that can be successfully shot per foot or drill or bore hole in bank shooting, where churn drill methods are used, varies from 4 to 20 tons per foot of hole.

As a general rule explosive costs per unit of stone produced show a saving with the churn drill method of drilling. There are exceptional cases, but few where churn drill blasting will result in higher costs. In practically all such cases they will be offset by the saving in drilling costs. Quite often, owing to the rough or steep slopes of quarries, it seems impractical or impossible to move heavy churn or well drill equipment about. If such is the condition, it has been found that it pays to build cribbing and roads over which the drill can be moved. The extra cost of such cribbing and preparation results in lowered drilling and blasting costs as compared with some other method of attack.

The secret of economical operations in any quarry or open pit operation is loading or removing the greatest volume of material or ground in the least time. This cannot be done unless the material or ground is properly broken up to permit as nearly as possible constant loading operations. There is nothing which has greater bearing on this factor than drilling and blasting. It will be found that it is good policy to increase costs of initial blasts either by spacing holes closer together or by using more or higher strength dynamite, thereby reducing secondary drilling and blasting to a minimum. Secondary blasting costs should never exceed from 15 to 30 per cent of the primary blasting cost. While secondary drilling and blasting costs are an item to be reckoned with, the actual delay to con-

tinuous loading operations is the big and costly item.

Where the churn drill method of drilling can be followed at all, it is in the long run the most successful in bank or even benching operations. Drilling, as one authority has said, is a most difficult and perplexing operation possessing what may be termed intangibility or the inability of being quickly remedied when difficulties are encountered.

In churn or well drilling operations it is to be remembered that as much or more hole is made by the crushing effect of the weight of the string of tools, drill stem, rope socket, and drill bits as is made by the chopping action derived from the sharpened end of the drill bit proper. This is not true, however, with shales; for in drilling shales it is a case of mixing the product rather than cutting or crushing it. With the exception of shale then, it would seem that the heavier the string of tools, the better and cheaper are the results. The weight of the entire drilling outfit, drill rig and tools must not be too great to effect its portability; otherwise it cannot be quickly and economically moved from one hole location to another but will become burdensome and unwieldy. Drill holes 4 to 6 inches in diameter are satisfactory, 5⅝ inches being about standard, giving good all around results in average quarries where limestone is produced. However, 4¼ inch diameter holes and sometimes 8 inch holes are found most economical in certain materials and formation. It is almost impossible without personal investigation and some experimenting to make recommendations as to proper balanced string of tools or proper weight of a string of tools, as class of material being drilled, length of stroke of machine, size of the cable and many other factors govern this. It is claimed that in average quarries, where limestone is produced and where faces range from 15 to 100 feet in height, that a well balanced string of tools should weigh aproximately 1250 pounds; bit 200 pounds; stem, 4½ inch x 20′ feet, 960 pounds and rope socket about 90 pounds. In some operations jars are used, but it is safe to say that 90 per cent of holes are drilled without jars. As a general thing, jars are considered a detriment except where they are absolutely necessary.

Dressing of the bit, shape, form and weight, and the speed at which the machine is operated all go in to make a success of drilling. There are, however, so many formations of rock or ground that it is hard to determine without investigation which is best suited for the conditions in hand. Originally, all bits were dressed by hand, but there has been a tendency in the last few years to go to special mechanical drill sharpening equipment. These special mechanical drill sharpening outfits have proved to be highly beneficial in numerous cases and are worthy of consideration. They have many advantages over the hand method of dressing. It is claimed by the manufacturers of such drill sharpening equipment that from 30 to 50 per cent increase in footage can be obtained with machine sharpened equipment, and that 80 per cent of labor in sharpening bits can be saved, to say nothing of the saving in wear and tear on tools. Regardless of what method of sharpening is used, the principal thing is to have bits properly dressed and on hand all the time. The drill bit which is used too long is false economy.

In the well or churn drill method of drilling it is the alternate lift and drop of the tools that actually does the work; so the speed at which the drill operates is an important factor. Where holes do not exceed 50 feet in depth and where straight away drilling is encountered with no seams or crevices, a speed of 53 to 60 strokes a minute will generally be found most satisfactory and desirable, depending upon the length of the stroke. Furthermore the longest stroke on the drilling crank should always be used. This speed of operation also keeps the drill cuttings and sludge in the bottom of the hole churned and in suspension, providing proper clearance of tools permits the drill bit, if drilling on the spring of the rope, to hit a clean and snappy blow at the bottom of the hole. This means additional footage. It is possible, however, to stuff too much iron in a certain sized hole to get clearance enough to allow suspension of the sludge in the hole.

If a little simple engineering, such as establishing a base line from which to take measurements for spotting drill holes and establishing bench marks for drill hole elevations, is injected into drilling operations, final results will be surprising. Each drill hole location should be measured off and elevation established at the top of the hole. After the hole is com-

pleted, it should be measured and checked to see that it is down to proper depth. A common error in bank method of attack is made in not sinking or drilling the hole below the established quarry floor. Holes should be drilled from 3 to 5 feet below the quarry floor grade, and if a mistake must be made, make the holes too deep rather than too shallow. The following rules for drilling operations may be helpful.

Approximately from 70 to 80 per cent of all drilling cable used on well drilling rigs is sold in coils of 200 feet in length. This length for ordinary depth drilling permits the cable or rope to be turned end for end when the end next to the tools becomes worn and also allows the making of several splices if necessary.

When rope is spliced, a long splice is desirable, as short splices are hard on rope guards and sheaves, tending to burst out the sides of the grooves of the sheaves.

Quite often manilla cable is worn and burned by constant rubbing and friction at the cable drum, due to the top wrap of rope wedging down between the coils of the next layer. To eliminate this a cable divider should be placed on the drum so that the unused part of the rope is coiled on one side of the drum, while on the other side only enough rope should be spooled for feeding off in hole and only one layer. This, of course, is not possible when exceptionally deep drilling is done, say 300 feet, as is sometimes being done.

Drill runners sometimes will "drill in the rope," as it is termed. This means that they are running with too tight a rope, resulting in all of the spring, stretch and life being taken out of the rope and no hole drilled. Instead of drilling in the hole, they are drilling in the rope, resulting in loss of footage also.

Drilling with too slack a rope is quite prevalent. This causes undue vibration to rope and machine resulting also in loss of footage, cutting down the life of the rope one-fourth to one-half and causing crooked holes which are a menace when loading holes with explosives.

Drilling on the "spring of the rope" is the ideal condition and means that the proper tension is being maintained in the rope or cable to secure the snappy blow which gives maximum footage with the least wear and tear on the equipment. To determine the proper amount of tension, stop the tools on the down stroke just as they are striking a blow, then raise them from 1 to 3 inches, depending on the depth of the hole, and put them in motion again. In exceptionally deep drilling, possibly more than 3 inches should be allowed, and stretch of rope and speed of drill should be taken into consideration.

Too much care cannot be given to taper joints on well drill tools. Drill tools are shipped with taper joints well greased to prevent rusting. All grease should be removed and threads washed clean with gasoline or kerosene before using. Each time as the threads are screwed up, a little water should be put on them as a means of lubrication. It is impossible to set a taper joint with grease on it so that it will stay tight.

It is very important that new taper joints be broken in properly the first time new joints are put together. They should be screwed up no tighter than to permit one man on the end of the wrench to pull them. by exerting a reasonable amount of strength. It is never necessary at any time to use a pipe extension on this wrenching bar, nor sledges to set taper joints properly as is sometimes done. This procedure only results in pulled threads and stretched joints, and the joints will come loose in the hole much more quickly than if properly set.

The drill bits should be so shaped that the water channel can be kept clean, and the cutting edge, while straight, should tend toward concave but never convex. It is impractical to attempt to lay down any general rules as to the shape of bits, the size and shape of cutting edge and wearing surface, as it is better in such cases to consult manufacturers of each equipment. They have experience and data always available.

Many fishing jobs are the result of a freshly dressed full sized bit being placed in a hole which has become tapered due to running the previous bit too long and allowing it to become undersized.

Drilling is certainly one operation around a quarry or open pit mine which can easily be put on a piece work basis, or on some basis such as a bonus, paying so much per foot for all over and above a certain number of feet which has been determined beforehand as a day's work. This stimulates interest. The writer is ac-

quainted with one operation where drilling on a strictly piece work basis with no guarantee to the drillers resulted in 50 per cent reduction in drilling costs. This method lengthened the life of drilling cable aproximately 300 per cent, and the drill runners or drillers earned from 300 to 400 per cent more per man per tower. Aside from this the additional compensation made drilling a preferred job and developed quite a number of good drillers in the organization. The practicability of establishing drilling on a piece work basis should not be overlooked.

Like blasting the drilling problems of the individual plant or operation should be studied, and a system of drilling should not be permanently adopted until some experimenting has been done. Failures or excessive costs due to incorrect practice and drilling in quarry or open pit mines will as a rule be reflected in every other operation in the quarry and in future drilling operations.

There is an unlimited field open for developing ideas affecting economies in drilling and blasting operations. Only after a thorough survey of a local situation by an experienced operator can proper methods of blasting and types of drilling and equipment be suggested.

Slate Industry Conference

The National Slate Association will hold its next Slate Industry Conference on January 19th and 20th, 1926, at the Hotel Commodore, New York City.

Freight Car Loadings

Loading of revenue freight for the week ended on November 7 totaled 1,063,322 cars, the sixteenth week this year that loadings have exceeded the million car mark, according to reports filed by the carriers with the car service division of the American Railway Association.

This was an increase of 68,043 cars over the corresponding week last year and an increase of 27,101 cars over the corresponding week in 1923. The total for the week of November 7 this year, however, was a decrease of 27,951 cars under the preceding week, decreases in the loading of all commodities being reported with the exception of coke and ore.

Coal loading totaled 189,212 cars, a decrease of 5,043 cars under the week before but 16,448 cars over the same week last year. Grain and grain products loading amounted to 46,242 cars, 1,195 cars below the week before and 8,523 cars under the same week last year. It also was a decrease of 2,773 cars under the same week 1923. Miscellaneous freight loading totaled 398,525 cars, a decrease of 18,141 cars under the week before, but 21,515 cars above the same week last year.

Coke loadings totaled 16,038 cars, an increase of 950 cars above the preceding week and 6,446 cars above the corresponding week last year. Live stock loading for the week amounted to 28,107 cars, a decrease of 2,440 cars under the week before but 1,057 cars above the corresponding week last year. Compared with the same week in 1923, it was, however, a decrease of 4,907 cars.

Ore loadings totaled 42,648 cars, an increase of 5,130 cars above the preceding week and 18,712 cars above the corresponding week last year.

A comparison by weeks follows:

	1925	1924	1923
November 7	1,063,322	995,279	1,042,221
October 31	1,091,273	1,073,374	1,035,424
October 24	1,121,459	1,113,053	1,073,841
October 17	1,106,114	1,102,300	1,073,095
October 10	1,106,099	1,088,956	1,075,938
October 3	1,112,462	1,077,747	1,079,775
September 26	1,120,645	1,087,954	1,097,493
September 19	1,098,428	1,076,847	1,060,811
September 12	975,434	1,061,781	1,060,563
September 5	1,102,946	920,979	928,916
August 29	1,124,436	1,020,809	1,092,150
August 22	1,080,107	982,700	1,069,915
August 15	1,064,793	1,019,077	1,062,993
August 8	1,051,611	941,407	978,750
August 1	1,043,063	945,613	1,033,466
July 25	1,029,603	926,309	1,041,415
July 18	1,010,970	990,230	1,001,350
July 11	982,809	909,973	1,019,800
July 4	864,452	757,904	850,082
June 27	901,341	908,251	1,021,471
June 20	982,600	803,546	1,005,432
June 13	987,106	902,592	1,008,838
June 6	994,874	910,793	1,012,312
May 30	920,514	986,209	820,551
May 23	986,209	918,214	1,015,532
May 16	984,916	913,201	992,319
May 9	981,370	908,213	984,078
May 2	981,711	913,550	961,617
April 25	959,225	878,387	962,578
April 18	922,778	876,916	970,042
April 11	917,284	880,937	945,271
April 4	922,375	961,990	896,375
March 28	931,395	907,389	896,735
March 21	909,363	908,290	916,818
March 14	924,149	916,762	904,116
March 7	930,009	929,381	905,344
February 28	862,910	944,544	916,624
February 21	925,295	945,679	830,187
February 14	902,877	935,589	816,646
February 7	928,244	906,017	849,352
January 31	896,055	929,623	865,314
January 24	924,254	894,481	896,464
January 17	932,150	894,851	864,297
January 10	932,807	872,023	873,908
January 3	765,727	706,292	727,246

Portland Cement Output in October, 1925

Production of Portland cement in October is second only to that of August, 1925, and shows an increase of nearly 8 per cent over October, 1924, according to statistics compiled by the Bureau of Mines, Department of Commerce. The seasonal decline in the shipments of Portland cement is shown by a decrease of 2,402,000 barrels in October as compared with September, 1925. This downward trend has begun one month earlier than in 1924. Stocks of Portland cement are 80 per cent greater than on October 31, 1924. The following tables prepared by the Division of Mineral Resources and Statistics of the Bureau of Mines are based mainly on the reports of producers of Portland cement. The October, 1925, totals include estimates for one plant.

Production, shipments, and stocks of finished Portland cement, by months, in 1924 and 1925, in barrels.

Month:	Production		Shipments		Stocks end of Month	
	1924	1925	1924	1925	1924	1925
January	8,788,000	8,856,000	5,210,000	5,162,000	14,155,000	17,656,000
February	8,588,000	8,255,000	5,933,000	6,015,000	16,815,000	19,689,000
March	10,370,000	11,034,000	8,995,000	10,279,000	18,189,000	20,469,000
1st quarter	27,746,000	28,145,000	20,138,000	21,456,000	.....	.....
April	11,726,000	13,807,000	12,771,000	14,394,000	17,159,000	19,877,000
May	13,777,000	15,503,000	14,551,000	16,735,000	16,403,000	18,440,000
June	13,538,000	15,387,000	15,036,000	17,501,000	14,903,000	16,409,000
2nd quarter	39,041,000	44,697,000	42,358,000	48,630,000	.....	.....
July	14,029,000	15,641,000	16,614,000	18,131,000	12,319,000	13,896,000
August	15,128,000	16,419,000	16,855,000	18,383,000	10,666,000	11,952,000
September	14,519,000	15,939,000	16,827,000	17,711,000	8,404,000	*10,247,000
3rd quarter	43,676,000	47,999,000	50,296,000	54,225,000	.....	.....
October	14,820,000	15,992,000	17,160,000	15,300,000	6,073,000	10,930,000
November	13,141,000	.....	10,289,000	.....	8,928,000	.....
December	10,435,000	.....	5,506,000	.....	13,913,000	.....
4th quarter	38,396,000	.....	32,955,000	.....	.....	.....
	148,859,000	.....	145,747,000	.....	.....	.....

*Revised.

Production, shipments, and stocks of finished Portland cement, by districts, in October, 1924 and 1925, and stocks in September, 1925, in barrels.

(000 omitted.)

Commercial District:	Production October		Shipments October		Stocks at end of October		Stocks at end of Sept.
	1924	1925	1924	1925	1924	1925	*1925
Eastern Pa., N. J., and Md.	3,598	3,851	4,298	4,108	677	791	1,048
New York	809	916	983	977	379	405	465
Ohio, West. Pa., & W. Va.	1,495	1,700	1,919	1,432	472	1,499	1,232
Michigan	1,030	1,171	1,132	1,062	282	825	716
†Wis., Ill., Ind., and Ky.	2,229	2,339	2,660	2,014	436	2,153	1,828
Va., Tenn., Ala., and Ga.	1,115	1,254	1,185	1,236	290	289	271
Eastern Mo., Ia., Minn. and S. Dak.‡	1,518	1,515	1,763	1,434	1,502	1,971	1,890
West. Mo., Neb., Kans., and Okla.	985	992	1,220	972	872	1,518	1,498
Texas	415	429	407	335	215	382	288
Colorado and Utah	275	212	278	179	181	399	366
California	1,062	1,189	1,036	1,201	364	439	451
Oregon, Washington and Montana	239	424	279	359	403	259	194
	14,820	15,992	17,160	15,309	6,073	10,930	10,247

* Revised. † Began producing June, 1924. ‡ Began producing December, 1924, and shipping January, 1925.

Estimated clinker (unground cement) at the mills at end of each month. 1924 and 1925, in barrels.

Month	1924	1925	Month	1924	1925
January	5,458,000	7,017,000	July	6,646,000	6,961,000
February	6,905,000	8,497,000	August	5,367,000	5,640 000
March	8,271.000	9,962,000	September	4,260,000	*4,561,000
April	8,545 000	9,731,000	October	3,548,000	4,082,000
May	8,225,000	9,053,000	November	4,025.000	.....
June	7,609,000	7,937,000	December	5,433,000	.....

* Revised.

Producing Talc at Rochester Vermont

By George Ransom

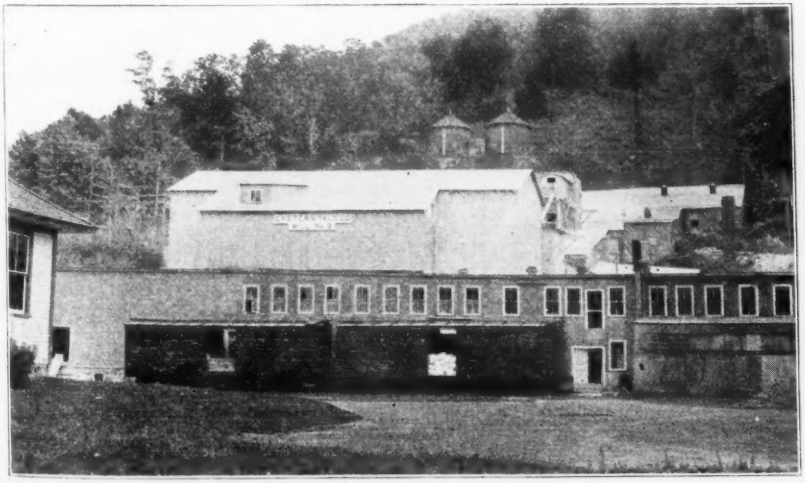
ALTHOUGH there is nothing startling in the idea of using switchback railroads in connection with coal mines, it seems to be rather uncommon in connection with such industries as the mining and milling of talc. Nevertheless this is the case with the operation of the Eastern Magnesia Talc Company at Rochester, Vermont, where the mine is located four and a half miles back in the mountains, and the mills in the valley of the White River, near the White River Railroad.

In the distance of four and a half miles from the mine to the other end of the railroad at the top of the incline leading down to the mill there is a drop of about 900 feet. Three switchbacks are consequently necessary to keep the grade within practicable limits, and even so it is as much as 8 per cent in some places.

The talc is carried in six ton steel, rocker dump cars and hauled by a saddle tank steam locomotive over 36 inch gauge tracks. Provision is made for the locomotive to take on water half way between the incline to the mill and the mine because even in pulling up a train of empty cars it cannot carry enough water to go the whole distance. It takes about 40 minutes to cover the distance, including stops at switchbacks and for watering, and during that time the boiler has to be fired at least ten times.

At the mill the cars are run one by one on to an incline truck and lowered down about 200 feet more to tracks leading to bins at the top of the mill. The descending loaded car pulls up an empty car. An engineer for the locomotive and two helpers to operate the brakes on the dump cars and the switchbacks, as well as the drum for lowering and raising cars over the incline, are sufficient for this transportation service. During slack periods trains, consisting of ten cars, may be run only two days a week, and under such circumstances the two helpers work in the mill between times. In winter a night watchman keeps up the fire in the locomotive to prevent freezing, but in summer this is uncalled for and he is dispensed with. As this implies, the railroad is kept running all winter with the help of a snow plow when necessary.

The mine is reached by a 45 degree shaft descending to a depth of 500 feet. On one side is a stairway and on the other a skipway. At present the last 100 feet is filled with water, and the mining is carried on at approximately the 400 foot level. The shaft is timbered with logs for almost 100 feet down, but thereafter it is through talc which does not require timbering.



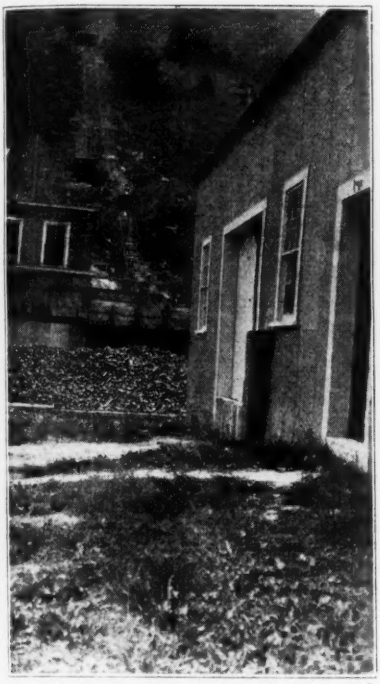
View of Outside Mill Showing Railroad Siding.

Outside Portion of Skipway Leading from Header House to Bins.

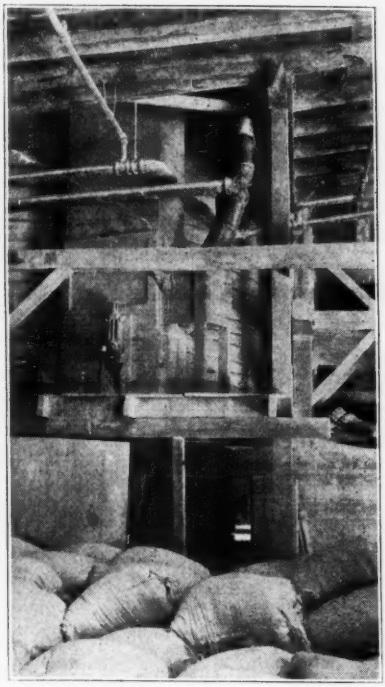
View of Incline from Railroad to Top of Mill.

The talc occurs in "lenses" between walls of other rock and varies considerably in width up to a maximum of something like 60 feet. At different levels, about 100-200 feet apart, more or less horizontal passages or "drifts" are run from the shaft. Cross passages are also made between parallel drifts on the same level. "Raises," or tunnels at 45 degrees with the horizontal drifts and cross passages, are cut at frequent intervals, and the raises themselves are branched and go to the opposite walls

Tracks to Right Lead to Dry Bins While Tracks to Left Lead to Wet Bins..



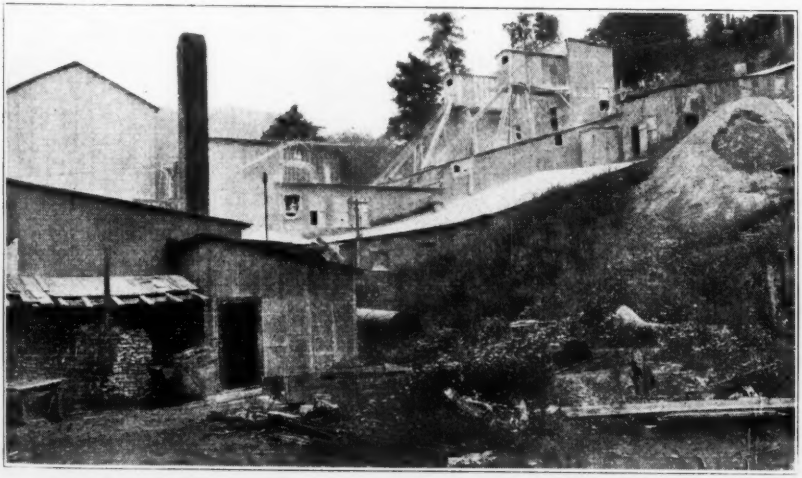
View of Incline from End of Railroad to Top of Mill.



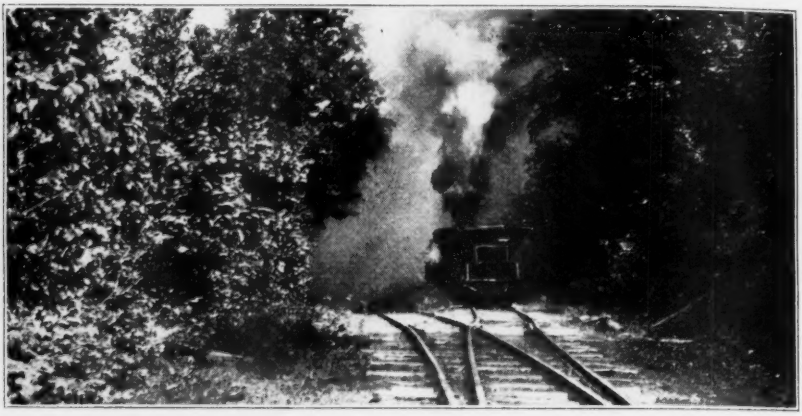
Interior of Mill Showing One of the Storage Silos.

enclosing the lens of talc. From the raises, which are comparatively short, other horizontal passages are opened up. "Stopes" are then run upwards at an angle of almost 50 degrees with the horizontal from the various "drifts" or horizontal passages and extend, as a general thing, to the next level above—perhaps as much as 200 to 250 feet, and sometimes 50 feet wide and 150 feet long.

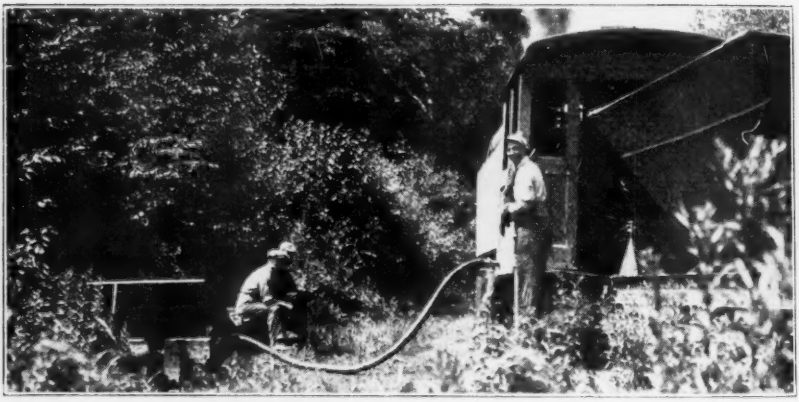
A number of electric lights have been placed in the shaft and along the passages. Of course adequate



Upper Part of Mill With Storage Bins for Raw Talc in Right Background.

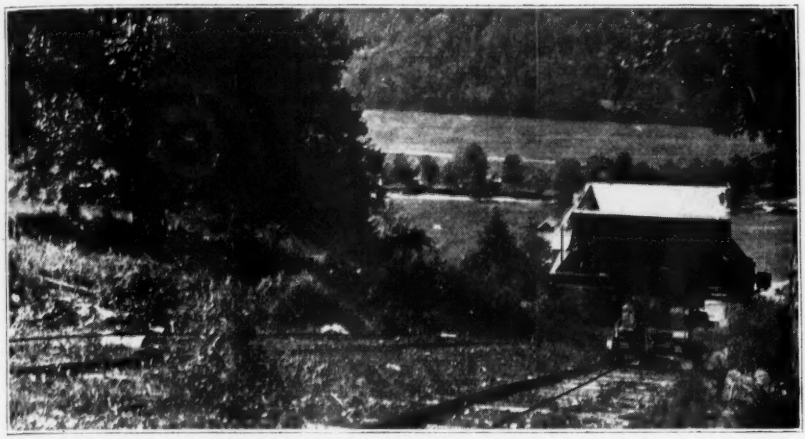


Train of Cars on Its Way Up to the Mine.



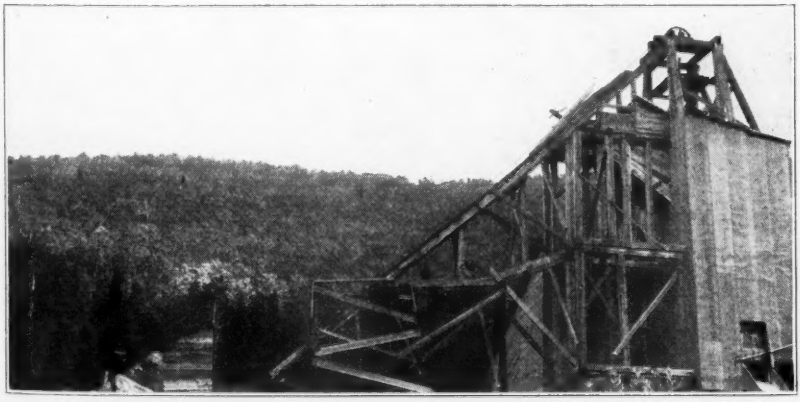
Locomotive Taking On Water Half Way Up to the Mine.

Locomotive With Train of Cars About to Start for the Mine.

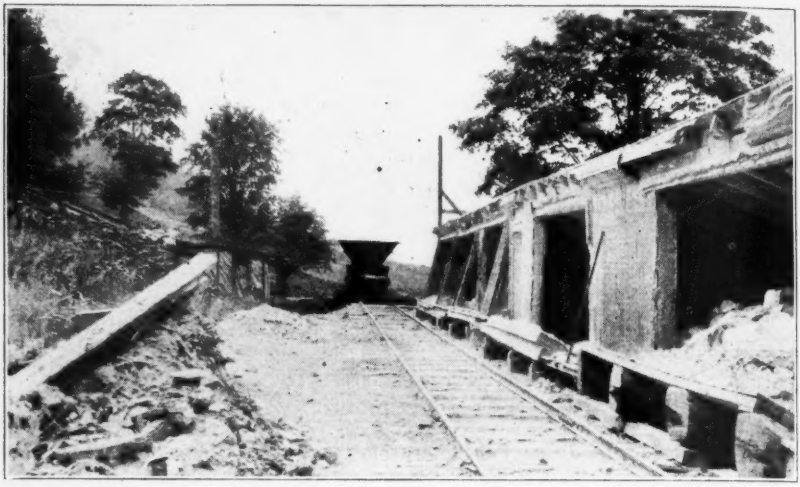


Empty Car on Incline Being Pulled Up from the Mill by Descending Loaded Car.

Dump Car on Incline About to Descend from the End of Railroad to the Mill.



Skipway Continuing from Mine Shaft Without Change of Angle to Header Bins.



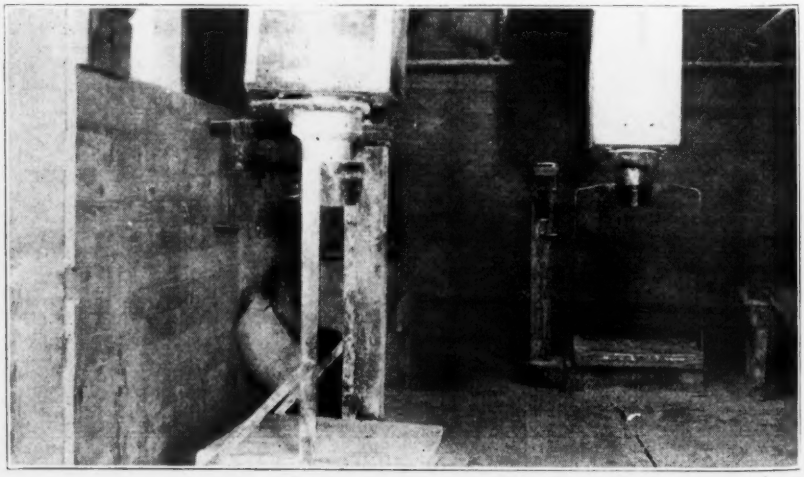
Tracks from Lower End of Incline Extending Along Front of Storage Bins.

lighting for all parts where ore is being taken out is impracticable so that the miners are provided with the usual acetylene cap lights.

Although the accumulation of water in the mine is not rapid enough to make its removal a very serious problem, it is necessary to have pumps of 140 gallons per minute capacity driven by 15 h. p., 440 volt induction motors. They are placed at different levels, each one pumping the water up to the next level until it is discharged at the surface.

The motors are supplied with current by a special armored cable made up of three rubber insulated conductors each of which has a lead covering. These three conductors are assembled under a common lead covering protected with two spirally wound overlapping steel taps and having an outer covering of jute saturated with asphaltum compound. This make-up insures the exclusion of moisture as well as protection against mechanical injury.

As the rock is taken out, it is passed over a grizzly at the bottom of the stope. Pieces going through the grizzly drop into a car on an 18-inch gauge track. Large pieces remaining on the top of the grizzly are broken up, usually by hand or by



Spouts Under Silos for Filling Bags by Gravity.

secondary blasting if necessary. The car is then pushed by hand and dumped into a bin at the shaft, whence the ore is drawn by gravity into the skip and hauled to the surface. An effort is made to keep the talc in as large pieces as possible because if it is reduced to a powdery condition, it becomes wet in the mine and requires drying. This is largely controlled by the method of blasting, but of course a certain amount of "zinc" is unavoidable.

The skipway extends above the surface without change in angle to the top of the header house where it is dumped automatically and the contents dropped into a screen. The lumps, which are dry, pass into bins from which there is a gravity chute under which the dump cars are loaded. The chutes and the tracks for the dump cars are covered with a shed to keep off rain and snow. After the cars are loaded, they are covered with tarpaulins to keep the lumps of talc dry.

The fine material from the screen passes into a wet bin where it is run through chutes by gravity into other cars, but being damp and requiring drying at the mill anyway it is not necessary to provide a shed. The arrangement of track for pushing cars under the chutes from the wet and dry bins is shown in two of the illustrations.

At the mill, as the cars of ore are taken from the incline truck at the bottom of the incline, which is at the top of the mill, they are pushed along a track passing along the front of a series of bins. There are seven of these, 3 for wet material which goes to a dryer and 4 for lumps which do not need to be dried.

The progress of raw material from bins to finished product is best shown by means of the accompanying "flow-sheet," which also gives the makes of various machines. From this sheet it will be seen that the mechanical handling of the talc in its progress from one stage of manufacture to another has been developed to such a degree that it is not touched by hand until the final bagging and shipping.

Talc is produced in sizes from 60 to 200 mesh for the roofing industry and 200 mesh for paper, paint and rubber making. The pulverizing is so complete in the latter case that there is a residue of less than 0.5 per cent on a 200 mesh screen.

The mill is completely electrified. Current is furnished by the Hortonia Power Company at 13,200 volts and stepped down to 440 volts by a bank of outdoor transformers. The motors are all induction motors of sizes for the various machines as follows:

One, 100 h.p. slip ring for roller Raymond Separator.
mill.

Two, 75 h.p. slip ring for two banks of pulverizers.

One, 30 h.p. squirrel cage for fan, Raymond Separator.

One, 25 h.p. squirrel cage for fan, Raymond Separator.

Header Bins with Shed at Right.

Two, 40 h.p. slip ring for jaw and rotary crushers.

One, 10 h.p. squirrel cage for motor generator for d. c. for magnetic pulleys.

One, 10 h.p. squirrel cage for hoist for taking to top of incline.

One, 15 h.p. squirrel cage for roll crusher.

One, 15 h.p. squirrel cage for bagging machine.

One, 5 h.p. squirrel cage for two conveyors and two elevators from roller mills and pulverizers.

One, 2 h.p. squirrel cage for conveyor of roofing grade from screen to silo.

One, 3 h.p. squirrel cage for exhausting dust from same silo.

One, 2 h.p. squirrel cage for bag shaker.

The installation of a mechanical bag shaker to clean the bags has been found to be a great labor saver. It also not only avoids the great quantities of dust stirred up by manual shaking but also avoids much grumbling on the part of the men who formerly had to do this by hand. Of course there is a great deal of dust in the mill which settles on the motors and belts. It is consequently necessary to blow out the former every day with compressed air. As regards the belts it is necessary, on account of the slippery character of the talc dust, to run them as tightly as practicable. Belt dressing has been abandoned because nothing has been found that is efficacious except keeping them tight.

The premises are kept neat and free from rubbish, which applies to the interior as well. The company operates four plants in Vermont and has a very complete and efficient organization, including, in addition to the regular operating forces, an engineering department for development and research along lines of introducing economies and finding new uses for its product.

General Electric steam turbines rated at 500. 600 and 750 kw. are described in Bulletin GEA-235, just issued by the General Electric Company, Schenectady, N. Y. The general principles and advantages of steam turbines are discussed, and sections and steam path diagrams are shown.

Recent Patents

The following patents of interest to readers of this journal recently were issued from the United States Patent Office. Copies thereof may be obtained from R. E. Burnham, patent and trade-mark attorney, Continental Trust Building, Washington, D. C., at the rate of 20 cents each. State number of patent and name of inventor when ordering.

1,557,697. Boom. Grant Holmes, Danville, Ill., assignor to Marion Steam Shovel Co., Marion, Ohio.

1,557,843. Screening apparatus. Henry P. Hoyle, Durham, England.

1,559,004. Dredge-bucket. John F. Rattigan, Homestead, Pa.

1,559,742. Mining-machine. Kenneth Davis, St. Benedict, Pa., assignor to Rembrandt Peale, New York, N. Y.

1,559,786. Feed control for pulverizing-mills. Otto A. Sauer, San Antonio, Tex.

1,559,915. Method of and apparatus for separating and blending molders' sand. George F. Royer, Wilkes-Barre, Pa., assignor to Royer Foundry & Machine Co., same place.

1,559,916. Separator for granular material. George F. Royer, Wilkes-Barre, Pa., assignor to Royer Foundry & Machine Co., same place.

1,560,049. Crusher. Edward H. Frickey, St. Louis, Mo.

1,560,136. Excavator-bucket. Jans J. Bentson, Muskegon, Mich., assignor to Austin Machinery Corporation, Toledo, Ohio.

1,560,147. Excavating-machine. Robert R. Downie, Beaver Falls, Pa., assignor to Keystone Driller Co., same place.

1,560,194. Crane or the like. Edwin J. Armstrong, Erie, Pa., assignor to Erie Steam Shovel Co., same place.

1,560,230. Skip-hoist equipment. William E. Hale, Fort Washington, Pa., assignor to R. H. Beaumont Co., Philadelphia, Pa.

1,560,370. Chain-bucket. Howard D. Bennett, Baltimore, Md.

1,560,522. Hoist. Edwin J. Armstrong, Erie, Pa., assignor to Erie Steam Shovel Co., same place.

1,560,766. Reversible mill. Joe Crites, Evanston, Ill., assignor to Raymond Brothers Impact Pulverizer Co., Chicago, Ill.

1,560,791. Shovel. William C. Anthony, Streator, Ill., assignor to Anthony Co., same place.

1,560,895. Excavating-bucket. Francis T. Crowe, Denver, Colo.

"We Call Our Plyth

THE Grove Stone and Sand Co. of Asheville, N. C. operates a wonderful deposit of garnet and silica sand, which was discovered when laying out the new resort town of Grovemont, N. C.—in the very heart of the southern play ground.

A modern plant was erected and equipped under the direction of Mr. G. C. Buquo, General Manager. No expense was spared in making it the "last wor iency omy of operation. T ith Ga comotives—a 4 and were c the haulage work. o writ

"We have now ope 7-ton Gasoline Locomotive gh to fied in stating that of the cient and satisfactor es of equipment. Our me e "Pa

Surplus Sand Utilized Advantageously

By E. D. Roberts

COMPETITION among sand and gravel producers in the Milwaukee territory is very keen. Local deposits were laid down by glacial action and in such a manner that there is a large percentage of sand. As a consequence, sand does not bring a very good price, and producers are constantly looking for outlets for the sand which will bring in a fair return in order that they may continue to operate at a profit.

The Badger Sand and Gravel Company of Milwaukee has been operating a pit located about seven miles northwest of Milwaukee and about one mile from the end of concrete pavement. This remaining distance to the pit is, however, good macadam. Loading was done by power loaders directly into trucks or by a small bucket elevator into a portable bin hoppered toward the sides with spouts to load trucks spotted alongside the bin. From 3 to 6 feet of overburden had to be removed by a Thew steam shovel which loaded the earth into dump wagons. These dump wagons hauled the dirt to a swamp at the north end of the track and filled it, thereby reclaiming it and making it available for the site of a concrete block factory which was later installed to use up the excess sand and to keep the plant in continuous operation during slack periods.

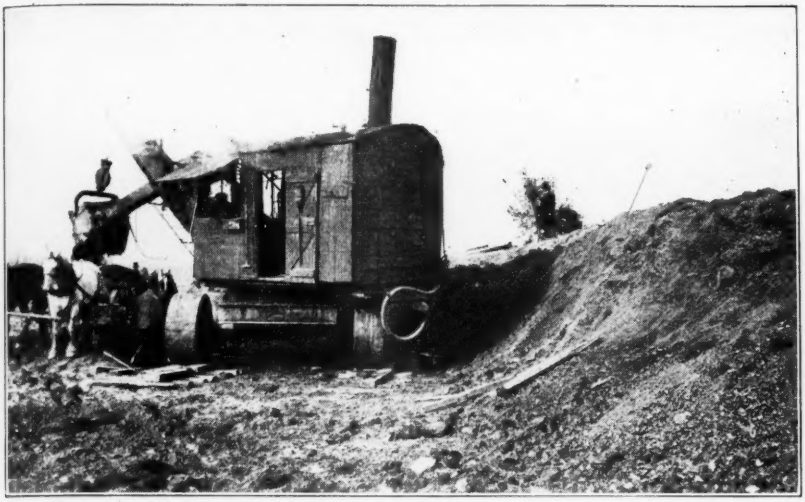
A short time ago the American Plaster Company of Milwaukee was reorganized and began putting out a gypsum plaster in which sand and retarder were mixed in the proper proportions ready for the addition of water at the time of spreading. Arrangements were made with this company by the Badger Sand and Gravel Company to furnish them a specified grade of sand suitable for the base coat product of the Plaster Company. This called for a modern plant to wash and grade the materials. At this same time, the Badger Sand and Gravel Company decided to put in a concrete block plant to utilize further the sand and make it feasible to install modern machinery for washing and sorting the material. An idea of the need for those outlets for their sand can be realized when it is known that the pit runs 80 per cent sand with 20 per cent gravel. The pit lies just west of the line dividing Waukesha and Milwaukee Counties. The excavation lies in the north side of a sand hill. The bank is 70 feet deep. The pit is kept stripped back 40 feet from the edge of the bank by a Thew shovel. Most of the sand is delivered within a radius of five miles from the pit. Mack trucks equipped with Heil bodies and Heil hoists and also Sterling trucks are used for this service.

A new 400 yard shipping bin with 4 compartments for their 4 products; mason sand, torpedo sand, pea gravel and number 2 stone, has been constructed. The process is as follows. A Waukesha 30 h.p. motor operates a hoist which digs the material with a

View of Deposit, Crushing, Screening and Washing Plant.

View Showing Character of Material Being Produced.

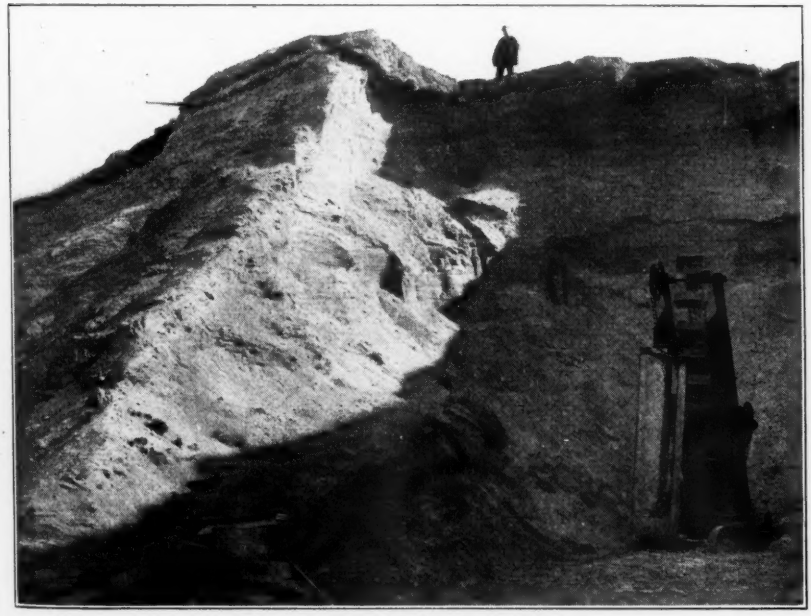
The Loading Bins.



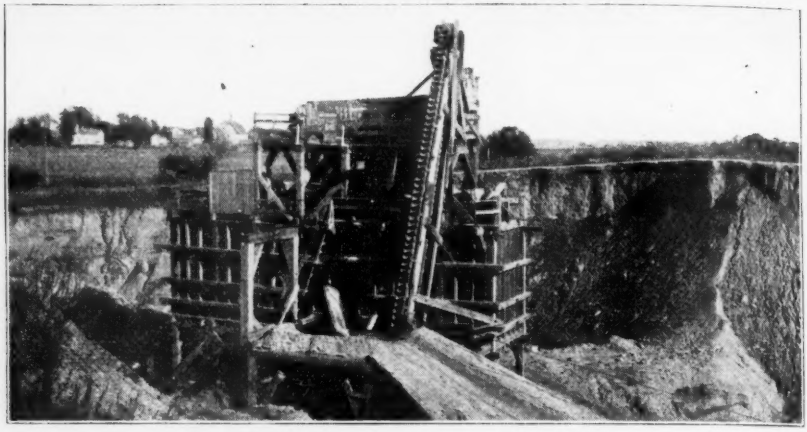
Material Excavated Loaded Into Teams.

Green drag line scraper. The material is hauled to a point opposite the shipping bin where it is deposited on a grizzly with bars set to reject rocks over 4 inches in size. The material falls through this grizzly into a hopper. A pan feeder under the hopper feeds the material onto an inclined grizzly which passes material under 1½ inch in size which falls directly into the boot pit of a Toepfer continuous bucket elevator. The oversize rocks pass directly into the jaws of a number 4 Allis Chalmers crusher which reduces the rock to 1½ inches and discharges it into the boot of the same bucket elevator which received the material passing through the second grizzly.

The Toepfer bucket elevator dis-



Close-Up View Showing Banks.



The Initial Grizzly, Crusher and Bin.

charges the crushed rock, sand and gravel into a Toepfer washing screen into which a large stream of water is played thoroughly washing the material. Pea gravel and number 2 stone are segregated from the sand and water by this screen and discharged directly into their respective bins below. The sand and water now passes through a Hummer screen which classfies the sand into torpedo sand and mason sand. Each grade passes into a separate dewaterer conveyor. This conveyor is really two screw conveyors placed side by side in an inclined box which raises the sand out of the water and discharges it into the bin below. Gates in the bottom of each compartment allow the drawing off of the sand or gravel into trucks spotted underneath the bin. Two additional Waukesha motors operate the crusher and bin machinery.

There is a call for bank run sand at times which is filled in the following manner. Two Atlas portable loaders operated by LeRoi gasoline power units load the sand directly from the bank to the trucks. The loader is backed into the bank, and the truck backs up to it. The loader then digs the material from the bank, elevates

Storage Bin Showing Truck Approach.

it and discharges it onto an inclined screen held in position by the loader. This screen rejects all stones and oversize material which is later drawn to the crusher and bucket elevator by the drag line. In winter, when it is imposible to wash material, this method of excavating and loading is used to fill orders.

The material for the concrete products is delivered by truck. The trucks dump the sand into a hopper set below the grade of the road. From the hopper it flows into the boot of a bucket elevator which raises the sand and discharges it ino a bin in the top of the block plant building.

The sand is drawn from the bin into a hopper alongside another hopper holding cement and both located over a screw conveyor which mixes the cement and sand with water which is sprayed into it as it passes along the conveyor. This machine is a number 2½ Kent continuous concrete mixer. The conveyor discharges into a small hopper, the bottom of which is a Kent plate feeder which feeds the mixed concrete to an inclined bucket elevator which discharges the mix into the tamping and casting machine. This machine, an Ideal Automatic Tamper, thoroughly tamps the concrete into the mold which has for its bottom a wooden palate on which the block rests after the form or mold is removed. A Waukesha motor again furnishes the power to operate all machinery of the block plant.

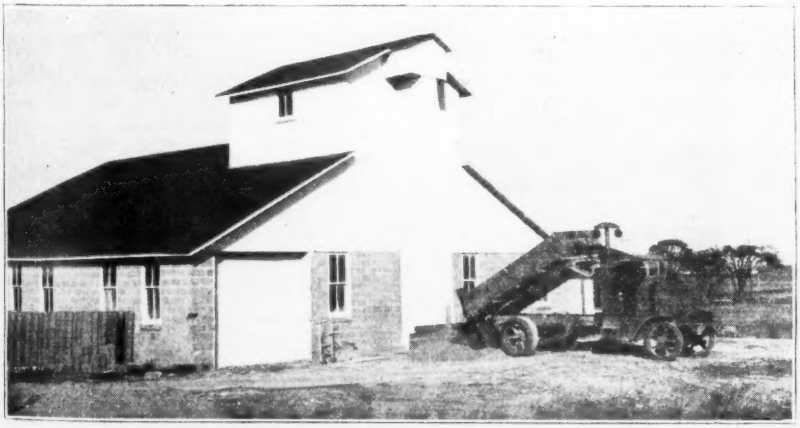
An operator transfers the block, by lifting the palate, to a rack holding 32 blocks. When this rack is filled, a truck is run under it and the rack is raised from the floor by means of the Barrett lift truck. This truck has rubber tired wheels and transports over a smooth concrete floor in order that there will be no jars to the green blocks. These racks are placed in one of the four large steam curing rooms for twenty-four hours after which they are trucked out into the storage yard and unloaded for further curing and until sold. Only four men are required to operate the block plant which is run only when these men are not required for operation of the screening and washing plant.

The tamping machine can be adjusted to produce 40 different sizes and shapes of hollow or solid blocks. This wide range of shapes has helped to create a satisfactory market for this by-product of the pit.

There are many operators who should look over their plants and materials to see if there is not some by-product which they are losing which could be turned into a profit, or whether it would not be possible to so process their material as to realize more from it. This has been done by the Badger Sand and Gravel Company, which has thereby served what would otherwise be ruinous competition.

R. C. Towles Resigns

Mr. R. C. Towles, who for the past two years has been directing the agricultural work of the National Lime Association, has resigned to accept the position of Agriculturist with the American Cyanamid Company of New York City.



The Concrete Products Plant.

Distribution of Cement

The following figures show shipments from Portland cement mills distributed among the States to which cement was shipped during 1925 up to and including September.

Shipped to	January 1925	February 1925	March 1925	April 1925	May 1925	June 1925	July 1925	August 1925	September 1924	September 1925
Alabama	85,410	103,513	177,510	191,541	185,314	214,195	256,741	277,605	167,959	192,882
Alaska	132	0	294	709	0	1,284	2,816	264	1,846	455
Arizona	34,370	25,945	27,009	31,264	32,749	32,451	37,842	33,328	39,176	34,380
Arkansas	41,370	44,352	72,198	94,695	87,340	92,101	78,059	88,143	114,134	54,377
California	98,883	753,123	1,029,118	1,027,744	1,081,945	1,066,088	1,061,048	1,154,523	936,834	1,120,092
Colorado	42,425	69,871	102,537	131,363	125,744	120,818	118,272	118,335	150,865	122,128
Connecticut	34,810	50,026	113,668	160,616	177,292	172,564	176,644	194,911*	193,380	232,265
Delaware	5,786	9,444	21,766	41,573	28,892	37,330	43,326	50,949	52,272	63,024
District of Columbia	37,285	65,176	58,474	70,765	103,996	81,334	82,133	83,155	79,399	84,260
Florida	265,463	227,811	272,094	261,180	313,846	348,330	341,849	310,457	220,021	522,465
Georgia	93,062	98,569	140,634	112,250	127,545	129,748	132,050	136,542	151,930	134,340
Hawaii	417	0	1,500	2,250	5,608	6,108	993	1,108	2,076	3,511
Idaho	2,598	11,029	17,667	28,393	28,613	28,122	28,498	31,846	30,221	24,959
Illinois	463,388	378,947	846,638	1,467,815	1,790,601	1,636,329	1,843,734	1,790,148	1,584,579	1,658,700
Indiana	139,782	143,464	255,597	433,996	569,436	617,360	658,042	690,042	764,188	625,962
Iowa	53,044	52,039	161,164	284,477	346,484	310,558	327,155	375,407	461,405	368,763
Kansas	33,588	120,405	212,402	232,220	242,880	233,522	226,787	254,074	228,064	205,607
Kentucky	52,013	68,970	115,222	174,795	195,351	231,491	229,652	220,859	222,361	196,628
Louisiana	75,992	97,638	98,193	108,250	99,402	100,016	99,111	105,440	116,770	80,907
Maine	4,837	5,238	21,702	36,163	38,435	43,541	41,475	37,277*	41,945	40,051
Maryland	47,635	98,231	143,291	207,844	231,935	249,105	247,835	235,983	230,946	260,019
Massachusetts	113,101	134,591	257,381	344,406	374,406	350,620	386,058	356,341*	364,320	326,615
Michigan	190,905	248,240	437,712	859,815	1,140,027	1,264,462	1,229,598	1,194,934	1,263,113	1,195,566
Minnesota	59,395	97,034	173,618	321,854	425,473	409,235	436,453	472,018	397,268	455,011
Mississippi	29,867	28,564	35,778	48,174	47,573	66,012	67,446	70,141	59,499	56,979
Missouri	115,141	162,992	379,157	489,316	652,330	583,561	683,097	723,916	501,596	597,568
Montana	5,334	6,093	16,450	23,030	28,170	28,904	31,486	31,638	24,935	24,598
Nebraska	31,832	46,281	99,780	180,951	198,338	181,516	203,863	210,305	204,610	206,703
Nevada	2,492	5,177	7,254	10,767	11,676	10,784	10,068	12,635	12,815	10,598
New Hampshire	9,419	15,911	27,592	39,906	36,814	40,837	41,843	52,941	37,872	48,675
New Jersey	157,612	243,534	498,227	722,751	721,605	737,572	760,944	653,685	756,579	809,251
New Mexico	7,911	10,320	18,865	19,699	17,141	18,406	16,323	17,246	29,306	12,945
New York	400,896	587,674	1,159,830	1,717,441	2,028,808	2,090,644	2,170,960	2,151,191*	1,953,647	2,006,604
North Carolina	79,817	128,770	200,097	277,616	289,056	324,201	343,683	340,027	295,252	354,835
North Dakota	1,380	3,742	16,589	38,937	47,789	66,089	55,305	37,735	24,990	33,458
Ohio	259,628	271,075	592,069	894,683	1,054,230	1,099,767	1,099,016	1,212,138	1,059,982	1,118,150
Oklahoma	58,872	155,083	203,161	201,886	235,096	225,879	225,729	286,912	185,550	195,542
Oregon	54,117	60,816	103,813	101,661	129,048	134,038	143,672	157,360	141,492	157,333
Pennsylvania	288,916	421,519	808,636	1,250,501	1,482,560	1,869,299	1,869,377	1,852,731*	1,672,054	1,937,173
Porto Rico	0	0	0	0	0	0	0	0	0	346
Rhode Island	15,688	17,908	54,083	79,063	72,914	89,213	75,383	71,369*	70,196	71,846
South Carolina	46,840	73,313	72,929	65,806	74,198	85,087	75,376	92,255	52,416	82,742
South Dakota	4,331	14,528	40,697	57,039	66,445	59,120	55,487	57,380	60,159	56,838
Tennessee	69,669	87,499	116,856	133,037	163,812	185,536	208,562	193,279	196,000	171,080
Texas	260,540	345,057	381,320	401,517	373,605	411,795	418,401	404,161	308,305	328,962
Utah	3,794	16,821	28,567	33,469	41,447	37,733	38,975	45,985	47,993	44,564
Vermont	3,129	3,060	10,312	25,353	24,178	26,978	26,245	23,698	36,842	28,794
Virginia	54,445	95,942	132,891	160,139	154,167	172,760	180,025	176,842	184,713	184,071
Washington	85,969	90,669	151,814	180,845	265,735	328,589	334,466	323,325	175,169	258,182
West Virginia	45,912	56,629	85,703	134,357	140,992	161,484	164,874	177,994	191,320	201,698
Wisconsin	113,396	73,320	142,620	358,379	507,654	569,687	562,363	626,004	603,204	513,479
Wyoming	3,492	9,181	16,358	19,981	32,466	31,290	25,691	31,042	38,823	20,461
Unspecified	15,964	26,430	46,236	34,875	8,023	3,996	48,647	10,520*	37,101	74,427
	5,092,090	5,961,563	10,205,073	14,327,067	16,659,016	17,417,489	18,033,478	18,258,726	16,777,497	17,610,869
Foreign countries	69,910	53,437	73,927	66,933	75,984	83,511	97,522	124,274	49,503	100,131
Total shipped from cement plants	5,162,000	6,015,000	10,279,000	14,394,000	16,735,000	17,501,000	18,131,000	18,383,000	16,827,000	17,711,000

Prime Movers in Stone Quarries And Sand and Gravel Pits

By C. H. Sonntag

PART III

The first part of this article appeared in the November 1st number of Pit and Quarry. The conditions under which a plant should generate its own power, the slide valve engine and the automatic steam engine were discussed. In the second part, which appeared in the November 15th number, the uniflow engine, the corliss engine, the steam turbine and steam power in general were discussed.

—EDITOR.

Internal Combustion Engines

The steam boiler, although not taken up in this paper, is a necessary adjunct of the steam engine. It makes the power plant more cumbersome, less portable, takes up room, requires coal, inspection, repairs, insurance and good water, and in the larger sizes requires operating labor. On the other hand the internal combustion engine is completely self-contained, requiring only a foundation, a building and a fuel supply tank, and the small ones can dispense with the foundation.

Classification of these engines may be based on their portability, on the nature of the fuel and on the means used to secure ignition of the explosive mixture in the cylinder.

From the standpoint of the fuel used, we may consider them under the following heads:

Gasoline engines.
Kerosene engines.
Light fuel oil engines.
Heavy fuel oil engines.
Gas engines.

As to the means of ignition, they may be spoken of as:

Low tension or make-and-break ignition engines.
High tension or jump spark engines.
Hot bulb or semi-Diesel engines.
Diesel engines.

The fuel used in an engine and the means of igniting it are rather closely bound together in its design, and so these machines will be taken up on the basis of the fuel, with a discussion of the ignition and means of governing under each.

In the larger sizes, Diesel engines are by some builders designed with cross-heads and piston rods and made double acting—that is, explosions occur on both sides of the piston. The same is true of the very large gas engines used in steel mills. But in sizes apt to be found in crushing plants and gravel operations, gas and oil engines will most likely be single acting and have trunk pistons like those in an automobile engine. Such a piston is purposely made long in proportion to its diameter so that it can take side thrust and act as its own cross-head, carrying the wrist or piston pin within itself.

Of the portable types the most familiar is the tractor. These are now so common that anyone with some knowledge of an automobile and a little mechanical ability can run one. Within the range of their capacity they are complete power plants, and American ingenuity has applied them in many odd ways. The writer has seen a Fordson dismounted and set on the frame of a blast hole well drill, which it was running nicely, and has seen two others with their rear wheels removed, connected by sprocket chains to the stern wheel of a scow on the Mississippi River.

Tractors must be started on gasoline, but most of them may be run on kerosene after warming up. The engines are usually vertical and have enclosed crank-cases in which a certain amount of lubricating oil is placed to be distributed to the working parts by the splash system. If kerosene is used as fuel there is a likelihood that some of it will work its way past the pistons into the crank-case, necessitating frequent changing of the oil. With the present relative prices of gasoline and kerosene there is some question whether, all things considered, it pays to use the latter in any vertical engine depending on electric ignition.

Ignition in tractor engines is always by jump spark, using the spark plugs and other ignition equipment that has been standardized for automobiles. Tractor control is primarily by hand throttle, but most of them have a governor that acts as a speed

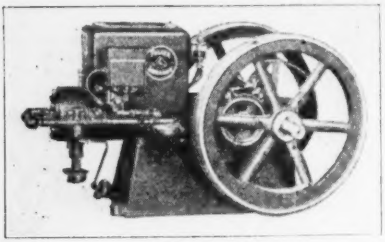


Figure 7—A Small Horizontal Gasoline Engnie.

limit device by partially closing the throttle. This is of particular value when they are used to deliver power by belt.

Tractors may be had in sizes ranging from about 15 h. p. to 75 h. p. or more. The number of ways in which they can be used is so numerous that it is impossible to mention more than a few. They may be found running portable crushers, both jaw and swing-hammer types, screening plants, pumps, small hoists, and in fact almost anything within the scope of their capacity. By means of special attachments they have been made to haul trains of small cars on narrow-gauge track, and in this way they may be of great service in the smaller quarries and sand and gravel pits, and in transporting concrete materials on portable track for paving contracts, although for the larger jobs heavier locomotives are desirable.

Gasoline Engines

These may be had with one or ore cylinders and in the horizontal or vertical types, but those with more than one cylinder are usually vertical. A typical single cylinder horizontal engine is shown in Figure 7. Two features that can be seen in this cut must be mentioned. The first is that the cylinder receives its lubrication from a sight feed oil cup. As the oil is used only once, such an engine will run well on kerosene when once heated up. The second feature is that the cooling is effected by the evaporation of the water in a large open jacket surrounding the cylinder. It is well known that an internal combustion engine is most efficient when as hot as possible consistent with lubrication of the piston. The open water jacket is probably more efficient in maintaining a high but safe temperature than a separate radiator.

Single cylinder vertical engines may also be had with open water jackets, and both types are common on concrete mixers, portable saws, well drills, small hoists and similar applications. Ignition on these engines is usually by jump spark, but some of them are specially built to use an oscillating low-tension magneto. In this the armature coil is pushed through part of a revolution by the valve mechanism of the engine and released at the proper time. It is pulled back into place suddenly by strong springs, the current induced in it passing through two points that project into the cylinder. At the moment of maximum current the points are quickly separated by a sort of hammer blow, and the spark between them ignites the explosive mixture. The advantage of this is that engine and magneto form a self-contained unit, batteries being dispensed with.

Governing of single cylinder engines is nearly always on the hit-

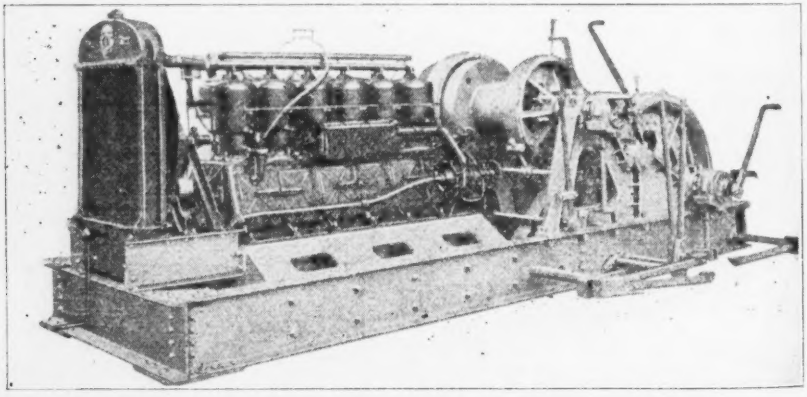


Figure 8—A Multi Cylinder Heavy Duty Gasoline Engine.

and-miss principle—that is to say, the engine ceases to draw in and fire the explosive mixture when the speed is above normal. This is accomplished by holding the exhaust valve open under the control of the governor. The result is a rather irregular speed, but steady enough for the uses to which these machines are put.

Vertical multi-cylinder engines much resemble automobile engines in that they run at high speed use jump spark ignition, and cool the jacket by water passing through a radiator, but they are built more heavily, since they are expected to develop their full rating a larger part of the time. The larger powers are arrived at by increasing the number of cylinders. Figure 8 is an unusual example of the use of a six-cylinder engine to drive a heavy hoist. Multi-cylinder machines are also being used on the larger concrete mixers and similar work. Governing is by means of throttle control, as in the case of traction engines.

Kerosene Engines

There is no particular type that can be considered as coming exclusively under this heading. As has been stated, the single cylinder machines with sight-feed oilers will run on kerosene, and the multi-cylinder machines will also if the resulting crank-case dilution is taken care of by frequent changes of the oil.

Light Fuel Oil Engines

These machines use as fuel those fractions of petroleum distillation that come over after kerosene and before the heavy lubricants, and that hence are free from the highest boiling and non-volatile constituents of the crude oil.

In the gasoline engine a mixture of gasoline vapor and air is drawn into the cylinder during the suction stroke and immediately compressed to about 60 pounds pressure, when the charge is electrically ignited. In the fuel oil engine air only is compressed to 250 or 300 pounds pressure, at which time a spray of oil is injected into it in such a way that the oil strikes the interior of a hot bulb, a hot extension on the piston or some similar device. The heat of compression aided by these other agencies ignites the charge. The combustion is of the nature of continuous burning rather than explosion. It is evident that no electric devices for ignition are necessary, and governing is by regulating the amount of oil fed to the cylinder at each stroke. Light fuel oil engines may be had in a range of sizes from 5 to 10 h. p. to 200 or 300 h. p., beyond which the Diesel engine should be used. They are made single or two-cylinder horizontal and single or multi-cylinder vertical.

The Diesel Engine

This machine is the highest development of the internal combustion engine for liquid fuels, as it is built in larger sizes than any of the others, and will make efficient use of fuel that the others can not handle. The basic principle is that of ignition by compression only. The piston compresses a charge of pure air to about 500 pounds per square inch, at which pressure it is so hot as to be able

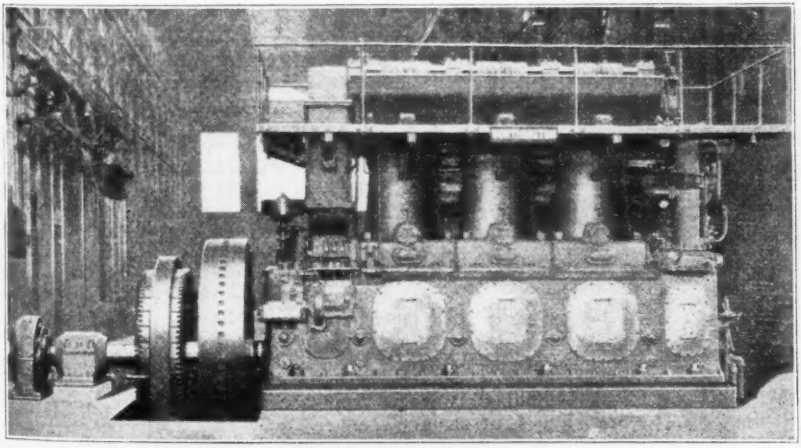


Figure 9—A Four-Cycle Air Injection Diesel Oil Engine.

to ignite the spray of oil injected into it at the end of the compression stroke This spray is admitted through an appreciable interval, during which time the piston starts on its working stroke. Governing is by control of the time during which the spray of oil is admitted.

Diesel engines are usually built of the multi-cylinder vertical type, Figure 9 being a good example. The high pressures used call for heavy construction, and Diesel engines are really very high grade machines. They are rather expensive per horsepower, and proper care and maintenance will prove good investments. They must be started by compressed air, provision for which is always made by the builders. They are also built as horizontal single cylinder machines in the smaller sizes, and are well adapted for direct connection to air compressors, although they may be used for other service also.

The Gas Engine

Nothing special need be said on this head except that any gasoline engine may be made into a gas engine by replacing the carburetor by a suitable mixing valve. Natural gas will be the most likely fuel, but there are sections of the country where coke oven gas is sold in large quantities at a price which will permit its use for power development.

Internal Combustion Engines in General

It will appear from what has been said that there is much latitude in the choice of these machines, but never-the-less each within rather wide limits its own field of application.

For driving portable pumps, crushers, etc., and in sizes up to 15 or 20 h. p., the gasoline engine is the logical selection, using kerosene in the larger sizes if the design warrants it, or using the small hot bulb engine.

From this size up to 150 or 200 h. p. the semi-Diesel engine will do the work nicely and using a cheaper fuel, though it will run on kerosene if occasion arises.

In sizes above 200 h. p. the Diesel engine has no real competition. It is a thoroughly high grade machine, and when fuel cost is to be kept at a low figure it will well repay its high initial investment.

These various engines become more efficient as we proceed from the light to the heavier fuels by about 50 per cent, meaning thereby that a gasoline engine will use 50 per cent greater weight of fuel than a Diesel. As the heavy oils are much cheaper per gallon, the fuel cost of a horse-power hour is far less with a Diesel engine than in one using the lighter oils.

Nothing has been said above about four cycle and two cycle operation, nor about many other details in which the products of various builders differ, but perhaps the discussion will aid the prospective purchaser in making an intelligent choice.

N. C. State College Professor To Conduct Cement Research

The recent appointment of George R. Shelton as assistant professor in ceramic engineering in the engineering experiment station of State College of North Carolina is significant in pointing the way to new uses for North Carolina resources of limestone, marl, shale and clay. Mr. Shelton is a specialist in cement and glass and will conduct research work looking to the creation of these industries out of natural resources of the State. At present, although there are well known deposits of the essential materials, neither of these industries has been developed in any way in North Carolina, and very little raw material shipped to foreign manufacturers.

Dr. Greaves-Walker, who heads the department of ceramica at State College, has hitherto been concerned with a study of clays and shales in connection with their use in the ordinary clay products, especialy brick and tile, and with the organization of a laboratory in which clays generally may be tested as to their utility for making these products, for use in potteries or otherwise. Research as to glass and cement, especially the latter, is a natural extension of the service of this department, and in the present circumstances one which is greatly needed.

American Concrete Institute

The Twenty Second Annual Convention of the American Concrete Institute will be held at the Hotel Sherman, Chicago. The convention will open on Tuesday, February, 23, 1926, and continue through Friday, February 26th. The headquarters of the American Concrete Institute have recently been moved to Room 214 Lexington Building, 2970 West Grand Boulevard, Detroit.

Magnesite Mining in California

By E. D. Roberts

SUCCEEDING where others have failed is the reward of Mr. C. S. Maltby of San Francisco, who is operating a magnesite mine near Red Mountain, Santa Clara County, California. The property was originally opened up in 1905 and operated by the American Magnesite Company for a time after 1912. This company was succeeded by the Western Magnesite Development Company, which went into the hands of receivers and was operated by them in 1917 and 1918. Mr. Maltby leased the property in 1919 and has been able to make it pay by the introduction of labor saving machinery, by improvements in the calcining process, and by developing a good market for his products.

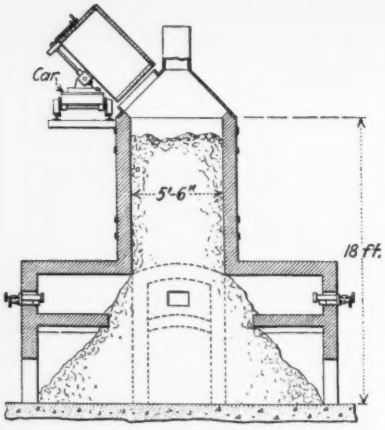
Mr. Maltby operates two magnesite mines, the one mentioned and one 42 miles from Mendota in San Benito County, California. The Red Mountain mine produces pure light burned magnesite for use as cold weather cement for which there is a great demand throughout the Middle West. The Mendota property produces dead burned magnesite containing about 2 per cent of iron which is used for lining kilns and furnaces where high heats are required.

At the Red Mountain mine the magnesite occurs in a series of veins of the lens type on the west slope of Red Mountain well above the reduction and calcining plant. The altitude of the plant is about 3,000 feet above sea level. The region has a large area of serpentine rock from which the magnesite has been derived by alteration. The veins are near the surface and occur in large masses. They are segregated into two groups; the White Diamond Mine and White Queen Mine.

Drifts have been run into the hillside and raises made to the veins and drifts run along the lower side of the veins. Stopers are used for raising the jack hammers for drilling underhand in pits and stopes and for bulldozing. The drilling is easy. Very little timbering is required to make the tunnels safe. The broken material falls on the footwall and is hand sorted into cars which transport it to the chutes loading to the lower levels. Over half of the broken material is wasted as only the best magnesite ore is transported to the reduction plant, the remainder being wasted on hillside dumps. The ore is drawn from the chutes into 1½-yard side dump Koppel cars and drawn by a home made locomotive using a Ford engine either to a bin or the waste dump. Two bucket wire rope trams transport the ore from the bins at the mines to the receiving bins at the reduction plant.

There are two different methods used in calcining, due to the utilization of equipment which came with the mine as well as the modern equipment just installed. The first method is the old shaft kiln method in which the magnesite is drawn off from the

A General View of the Calcining Plant.



Sectional View of Shaft Furnace for Lump Magnesite.

bin into a charging car which dumps the charge into the top of the kiln, the calcined material being drawn off at the bottom when properly burned. There are four kilns of this type with an average capacity of 15 tons of light burned magnesite daily using from 30 to 35 tons of raw magnesite each during the same period. The calcined magnesite is drawn off onto a cooling floor and when cooled sufficiently is raked onto a belt conveyor which runs alongside the cooling floor. While it is traveling along this conveyor, all sorting or picking is done, the extra quality being dropped into one bin, the slightly colored into another bin, and the underburned pieces into a third. The remainder is passed through a trommel which allows the small pieces to fall into a bin for shipment while the oversize goes into the same bin as the under-burned pieces, these rejects being returned to the kilns for further reduction.

The second or modern method of calcining used utilizes a rotary continuous furnace 55 feet long. This method allows the use of raw magnesite which had to be wasted where the shaft kiln type of calcining is in use. A belt conveyor draws off the raw magnesite from the bin previously installed at the wire rope tram and conveys it to the new bin over the initial breaker. While it is traveling the length of this belt, sorters throw out objectionable pieces to refine the ore. From the bin at the end of the conveyor belt it is drawn off and fed into a 9x15 Western crusher reducing the rock to 2 inches in size and discharging into a Bodison rotary screen which rejects all pieces over 1 inch in size and discharges them into an 8x10 Farrel crusher set for ⅞-inch material. The discharge from this last crusher falls into the same bin into which the material passing the 1-inch screen was discharged by the screen.

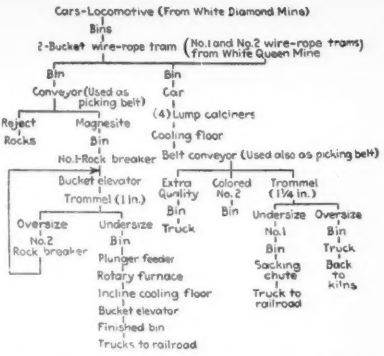
A plunger feeder draws the material from the bin and feeds it into the 55 rotary kiln to be calcined and discharged onto an inclined cooling floor. This cooling floor consists of sheet steel plates supported by steel rails. There are two compartments of this cooling floor each of which is used

Interior View Showing The Rotary Continuous Furnace.

intermittently. When cooled, the calcined magnesite is discharged into the boot pit of a bucket elevator which delivers the material to the finished bin.

The power units in use are either steam or gasoline. Due to the limited amount of power required, it was not found advisable to construct a transmission line to the mine for its electrification. Three Chicago pneumatic 14x9 inch semi-diesel engines furnish power for compressed air for mine operation. A 20 h.p. Western gasoline engine drives the rock crushers, feeders, screen elevator besides operating the rotary furnace. Plant lighting is furnished by a generator driven by a steam engine. A small steam engine operates the screen and belt conveyor used in the oil process. Two oil fired boilers furnish the steam for operating the steam engines. Oil is also the fuel used for calcining in all of the kilns.

The calcined magnesite is hauled to Livermore, a station on the Southern Pacific and Western Pacific Railroads, by auto truck on a contract basis of $4.25 per ton. The best grade is hauled in sacks for shipment via the Panama Canal to eastern markets, while the slightly colored is hauled in bulk and dumped into a storage bin from which it is loaded directly into cars for shipment in bulk. The rate allows a free haul to the plant of materials and supplies up to 25 per cent of the tonnage hauled out. This cares for the hauling of fuel oil to the plant, 50 gallons of which are required for



Flow Sheet of the Magnesite Plant.

each ton of calcined magnesite. Ten to fifteen trucks are kept busy on this contract during the open season. The haul being over a road which is impassable soon after the rainy season begins, the plant has to suspend operation for part of the year although development work is carried on throughout the entire year.

The success of this enterprise is partly due to careful manipulation of expenditures until a market for their product was developed. The local territory could not take the entire output which called for competition with imported magnesite in the middle western states and development of a market there.

All conveying, elevating and screening equipment was made and furnished by the Bodinson Manufacturing Company of San Francisco. Mr.

A Magnesite Deposit in California.

Maltby designed all of the new installations and has directed any change in process or equipment made in the older parts of the plant. Mr. Maltby also operates another magnesite mine in San Benito County transporting the calcined product 42 miles by auto truck to Mendota, the nearest railroad shipping point.

Dead burned magnesite for use in firing kilns and furnaces is produced by this property due to the fact that it has the proper proportion of iron to undergo the high temperatures required in burning.

Open pit mining methods are used to procure the raw magnesite ore which is shot up and then loaded into dump cars by hand. The sorting is done while loading, the best being transported to the mill and the balance wasted.

The ore is passed through a primary crusher which reduces the size to 2-inch. A scalping screen rejects the material over 1 inch which is further reduced to ⅞ inch by a number 4 Telsmith reduction crusher. The discharge from the Telsmith crusher and that passing through the scalping screen is conveyed to a bin over the kiln feed. From this bin the crushed magnesite is fed to a 7 by 80 foot rotary kiln which produces the calcined magnesite. Oil is also the fuel used in calcining at this plant. The plant is far removed from electric transmission lines and is operated by a 75 h.p. Brownell single action steam engine. The Bodinson Manufacturing Company also furnishes all conveying and screening equipment for the plant. Forty tons of dead burned magnesite are produced per day and hauled to the railroad station at Mendota.

The Tampa Cement Plant Project

CONSTRUCTION will start this month on the $5,000,000 portland cement plant to be built at Tampa, Florida, by the Cowham Engineering Company for the Florida Cement Company.

This plant will aid materially in the industrial development of the state and will relieve to a large extent the difficulty that builders and contractors are now having in obtaining cement. The plant will have an annual capacity of 1,500,000 barrels which will make it one of the largest industrial developments in Florida. The site selected is at Hooker's point on the Hillsborough Bay water front within the city limits of Tampa. Shipments can be made by truck, rail or boat. The 25 acre plant site was obtained from the Seaboard Air Line Railroad. Raw materials will be secured from a 600 acre tract of limestone and clay located near Brooksville, Florida. The latest improved design in cement mill construction will make the plant one of the most modern in existence. The plant will be equipped with three rotary kilns each 175 feet long and 11 feet in diameter. The waste heat from the kilns will be utilized to furnish power and light for the entire plant. A complete dust proof system will be installed. Steel and concrete construction will be adopted. Immediate plans call for the building of concrete silos with a storage capacity of 200,000 barrels. Provision will be made for doubling this capacity should conditions warrant. The Cowham Engineering Company will handle all construction details and they will also operate the plant upon its completion.

The Florida Portland Cement Company has been organized with John L. Senior of Chicago as its president. Mr. Senior has been identified with the cement industry for a number of years and is known for his successes in cement plant operation. He is president of the Signal Mountain Portland Cement Company of Chattanooga, Tennessee, the Peninsular Portland Cement Company of Cement City, Michigan, and is a director of the Peerless Portland Cement Company, with plants at Union City and Detroit, Michigan, and the Trinity Portland Cement Company of Fort Worth and Dallas, Texas.

Mr. Senior is also president of the Cowham Engineering Company which has specialized in cement plant design, construction and operation for over thirty years. It was one of the first companies to realize the potential market of the South for portland cement by building in 1902 the plant now operated by the Southern States Portland Cement Company at Rockmart, Georgia. Its latest plant was the Signal Mountain Portland Cement Company of Chattanooga, which was put in operation in the fall of 1923 and is now producing 1,500,000 barrels a year.

Retarders for Portland Cement

By Ernest E. Berger*

Part III

The first part of this article appeared in the November 1st number of Pit and Quarry. The work of other investigators, the preparation of cement and retarder samples, the method of proportioning and mixing the retarder, the determination of time of set, the determination of tensile strength and the relation between the chemical composition of clinker and its reaction with different forms of retarders were discussed. The second part, which appeared in the November 15th number, was concerned with the effect of different retarders on consistency and plasticity of clinker and the effect of different forms of calcium sulphate on the time of set of portland cement clinker.—EDITOR.

MANY investigations on the effect of retarders in portland cement clinker have entirely neglected the relation between the form of retarder used and the strength of the cement. The present investigation points out very clearly that the factor of strength deserves fully as much consideration as the time of set. Neglect of this factor may account for the wide divergence of opinion on the subject of retarders at the present time. For example, sample number 18 is sufficiently retarded by the use of anhydrite but the tensile strength is much lower than that retarded with plaster. On the other hand, the strength of samples numbers 1 and 2 is practically independent of the form of retarder used; however, proper retardation is not obtained by the use of anhydrite. Therefore, each sample tested for time of set must also be tested for strength before proper comparison can be made with any other sample.

It was difficult to know just how to arrange the tensile strength data so as to obtain a fair comparison between the strength of cement containing the different forms of retarder; but as the SO_3 content is usually carried between 1.50 and 2.0 per cent, and as this was near the percentage required for all retarders except plaster and was within the range showing the least variation in strength, it was decided that it would be most logical to confine the comparison of the different retarders to this range in SO_3 content. Thus the data which are plotted on the curves represent the average tensile strength of those mixtures which contain from 1.50 to 2.0 per cent SO_3. This range has included several samples containing plaster which were quick setting; consequently it has been necessary to include also the average strength of those samples which were properly retarded in order that undue value would not be given to plaster as a retarder. These data are represented by the dotted line in figures 5 and 6.

It was not possible to make satisfactory briquets with all samples of clinker, but the results obtained with the nine samples are important in that they show how much the strength is benefited by each form of retarder, and it also emphasizes again the importance of a study of strength in evaluating any form of cement retarder. A study of figure 5 will show the weakness of the clinker as compared with the cement containing 1.50 to 2.0 per cent SO_3 in any form of calcium sulphate, but it will be noted that in all instances there is a definite relation between the strength of the clinker and that of the finished cement. Therefore, it would be valuable if some information could be obtained which would point out the physical or chemical properties of the clinker which control this important factor.

On the addition of plaster of Paris there is a gradual increase in strength. This effect is quite independent of the time of set, for the time may change from a flash set to a normal set of three or four hours within a variation in SO_3 content of less than 0.20 per cent (See number 3), while strength continues to increase until the SO_3 plaster is approximately 2.0 per cent. Few tests were run by the writer with percentages greater than this, but the work of Lewis shows that the strength begins to decrease rapidly after this percentage is reached.

A study of figure 5 shows that cement retarded with plaster has greater strength than that retarded with any other form of calcium sul-

*Assistant Chemist, Bureau of Mines, Department of Commerce.

phate. Some of this advantage is lost because the amount of plaster permissible for proper retardation is often less than that required for maximum strength. The dotted line in figure 5 represents the average strength of the samples containing plaster of Paris which have a normal set, but even this is above the strength curve for gypsum or anhydrite except for samples numbers 1 and 9. (The strength represented for the latter sample containing plaster is somewhat misleading as a reference to the table will show. It includes one mixture containing only 0.50 per cent SO_3 while the mixture with 0.87 per cent SO_3 as plaster is equal to that containing 1.87 per cent SO_3 as either gypsum or anhydrite.

The use of plaster as such is, of course, not economically possible, and furthermore the necessity for close control of the SO_3 content might make it somewhat undesirable. A study of the mixtures indicates, however, that plaster should make up only that part of the SO_3 necessary for proper retardation. On the other hand, a study of the comparative values of each retarder shows the improbability of obtaining the best portland cement unless this percentage is present. Therefore, it seems desirable that there be some control of conditions in the tube mill as well as in the kiln if the most desirable cement is to be obtained; for in so doing there might be some control of the percentage of each form of retarder produced, and consequently the strength of the resulting cement might be more definitely governed.

The relation between the strength of cement containing gypsum and that containing plaster is shown in figure 5. All the samples are not represented, since some of them containing gypsum were quick setting and consequently could not be tested. Those which have been tested are invariably weaker than corresponding samples retarded with plaster. It has been noted by Lewis that an excessive percentage of gypsum is not as injurious as excessive plaster, but the tests of von Schindler show that on longer aging the gypsum will also weaken the cement. It was found that the limit which could be used varied with each individual sample, however, the limit in most cases was reached when the SO_3 content approached 3.0 per cent. Lewis stated that if there were any difference between the action of plaster and gypsum it was because the SO_3 in the former was in a more nascent state and the reaction could take place more rapidly. That is, the difference was to be accounted for by the amount of this material which entered into the reaction and not to the individual properties of the salts containing it. Thus, it would seem to depend on the difference in solubility or rate of solubility of the two salts as suggested previously. A more simple relation must also be considered in regard to strength. It is a well known fact that the strength of cement is inversely proportional to the amount of

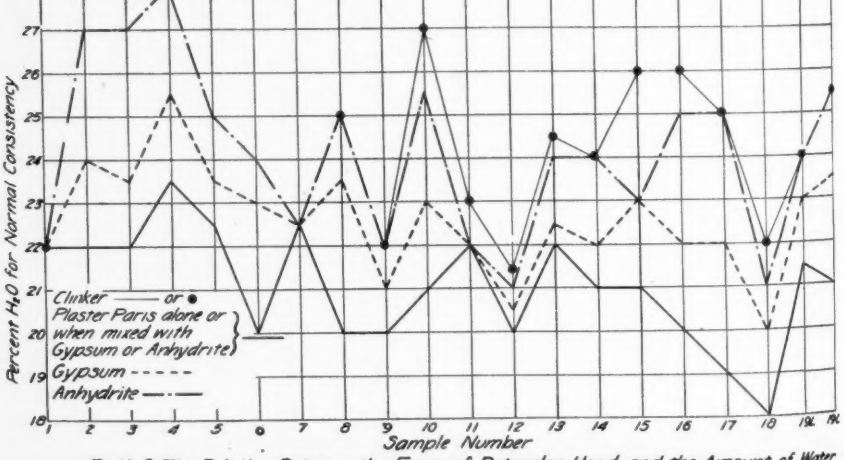


Fig. No. 2—The Relation Between the Form of Retarder Used and the Amount of Water Required for Normal Consistency.

mixing water used and a study of figure 2 and 5 together shows that the difference in strength of the mixtures containing gypsum and plaster is closely related to the difference in amount of mixing water required to bring each up to normal consistency.

Likewise the cement containing anhydrite, which requires even more mixing water, produces the weakest cement of all. It is interesting to note that it is stronger in samples number 9 and 18 than the mixtures containing gypsum, even though the latter require slightly less mixing water, and for sample No. 1 where 21 per cent of mixing water is used throughout, the strength of all the mixtures is the same (within experimental error).* However, this sample of clinker which also requires 21 per cent of water is still considerably weaker than any of the mixtures of cement; consequently, the effect of the SO_3 must be due to some chemical action which it has with the clinker as well as to the action which it has on physical properties. This would seem to indicate that the ultimate chemical reaction is independent of the type of retarder used, but that the action with gypsum or anhydrite is slower than with plaster. Consequently, the reaction is not completed within the ninety seconds alloted for mixing the cement, and its plasticity is not increased to the maximum before being tested. The larger amounts of mixing water required for proper consistency would then account for the weakness of the cement containing gypsum or anhydrite. Furthermore, in order to retard a clinker which has a flash set, it is necessary that its reaction with the SO_3 ion be almost instantaneous, and plaster of Paris seems to be the only one of the three forms of calcium sulphate investigated, which has a rate of solubility that will satisfy this demand.

The claim that the different result produced by each form of calcium sulphate is caused by the difference in the rate of reaction of each of these forms with the cement clinker, is materially strengthened by a study of mixed retarders. Figure 6 shows that as long as there is sufficient plaster present to retard the clinker, a cement retarded with equivalent proportions of plaster and anhydrite is equal in strength to one produced by the addition of plaster alone, and figure 7 shows that a similar mixture of plaster and gypsum is equally efficient. Therefore, the condition is what would naturally be expected, the SO_3 from any form of calcium sulphate would produce the same result except for the fact that the lower solubility of some of the forms of calcium sulphate makes the reaction with the clinker too slow, and consequently

*The consistency of the mixtures of number 1 containing plaster was determined on the portion of the sample ground first, while all strength tests were made on the second portion of the material. Consequently, a smaller amount of water may have been used with those mixtures containing plaster, which were used in making the tensile strength tests. However, since the same amount was used throughout, data have been obtained which suggests some rather interesting facts regarding the relation between the action of the different retarders.

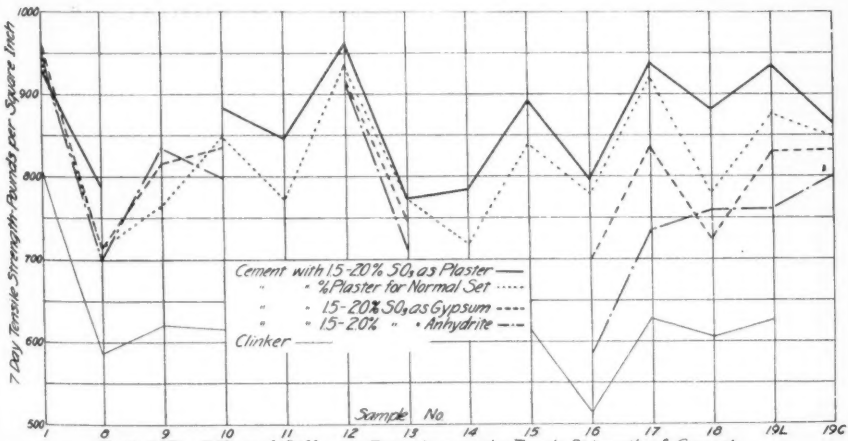


Fig No 5- The Effect of Different Retarders on the Tensile Strength of Cement. Curves Represent the Average Strength of all Briquettes Containing SO_3 Specified in the Legend.

the more rapid reaction, namely, the hydration of the clinker by the mixing water, takes place first and the full benefit of the SO_3 is not received. However, when there is sufficient plaster present to retard the hydration process of the clinker, the results obtained are practically independent of the type of calcium sulphate which makes up the rest of the SO_3 content.

The question would naturally arise as to why one should use a larger percentage of SO_3 than is necessary for proper retardation; however, a glance at the table shows that proper retardation with plaster is reached long before there is sufficient SO_3 to produce the maximum strength. Furthermore, perhaps because of the set of plaster itself, cement retarded with plaster becomes quick setting again before the maximum strength is reached. Herein lies the important advantage in the use of mixed retarders. Figure 6 shows that cement retarded with equivalent portions of plaster and anhydrite attains a strength equivalent to the maximum strength that could be obtained by the use of plaster alone, and as a rule it is considerably greater than the strength that could be obtained with plaster of Paris unless this compound were present in sufficient quantity to again produce a quick setting cement.

In the few tests made using a retarder which contained 70 parts SO_3 as plaster and 30 as anhydrite, the retarding reaction is the same as when a 50-50 mix was used, and figure 7 shows that the tensile strength is practically the same in both instances. It would be necessary to use the richer mixture, however, in a clinker like sample number 4 where the total SO_3 content must be raised above 20 per cent when a 50-50 mixture is used, in order that the SO_3 as plaster may be sufficiently great to retard the clinker.

The above indicates that a retarder made up of both plaster of Paris and anhydrite is superior to a retarder consisting of any one form of calcium sulphate. However, the data in this investigation indicate that through partial dehydration of gypsum by the heat of grinding, a mixed retarder containing both plaster and gypsum is now being produced in mill practice and the question arises as to whether one mixture would be as efficient as another, or whether after all the retarder used at the present time is not the most efficient. To obtain data on this point some plaster-gypsum mixtures were included in the tests and a study of the comparative strength of cement containing different mixed retarders shows, as indicated in figure 7, that for the samples tested, one

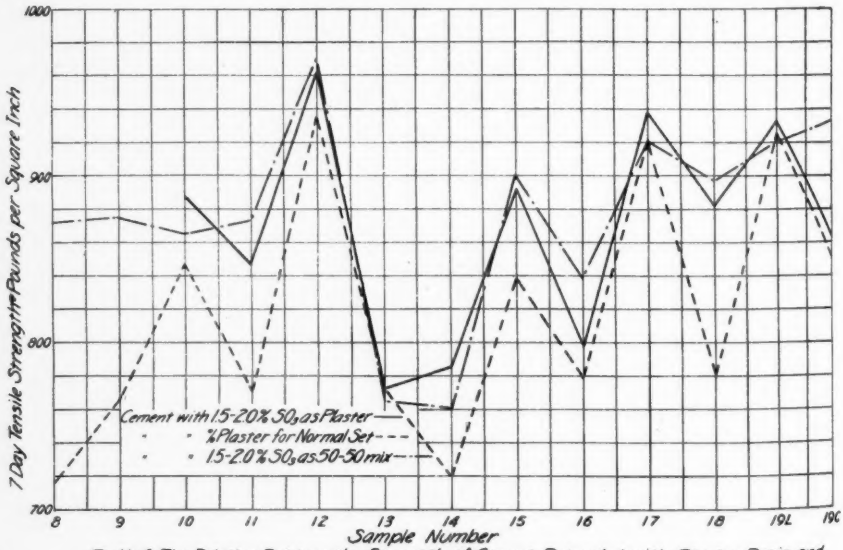


Fig. No. 6-The Relation Between the Strength of Cement Retarded with Plaster Paris and Retarded with a Mixture Containing Equivalent Amounts of Plaster and Anhydrite. Curves Represent Average Strength of all briquettes Containing SO_3 Specified in the Legend.

type of mixed retarder is just as efficient as another.

This evidence substantiates the statement that as long as there is sufficient SO_3 present as plaster to retard the cement properly the action of the remaining SO_3 with the clinker is independent of the form of calcium sulphate from which it is produced, and consequently it would be permissible for the cement retarder to contain equivalent portions of anhydrite and plaster except in a few cements where it is necessary to increase the percentage of plaster in order to obtain properly retardation. However, it must be remembered that this conclusion is based on laboratory tests where it is possible to know exactly how much of each form of calcium sulphate is present, and no claim is made that such favorable results would be obtained with the control maintained in mill practice. This can be determined only by tests conducted on a commercial scale.

The questions which must be answered are: first, what is the minimum amount of SO_3 as plaster of Paris which is required to retard the clinker, and second, what percentage of the retarder must be composed of gypsum in order that this amount of plaster will be produced when the clinker and retarder are ground together at the mill? That is, if equivalent portions of gypsum and anhydrite were added to a clinker requiring 1 per cent SO_3 as plaster for proper retardation, in a sufficient quantity for the cement to have a total SO_3 content of 2 per cent, and all the gypsum were calcined in the tube mill, the resulting cement would have a normal set. On the other hand, if only half of the gypsum were calcined, it would be necessary for the retarder to contain a larger proportion of gypsum so that the minimum amount of plaster would be produced, or it might even be necessary to use straight gypsum. Such studies would be greatly facilitated if some method were developed for determining the percentage of each form of calcium sulphate present in Portland cement, but since no such method is available at present it will be necessary to solve this question in a practical manner by conducting tests in the mill.

Suggested Mill Tests on Mixed Retarders

The following outline for the mill tests is suggested:

1. Set aside a supply of well mixed clinker for the test so that a uniform product will be used.
2. Note the conditions in the tube mill and keep them as nearly constant

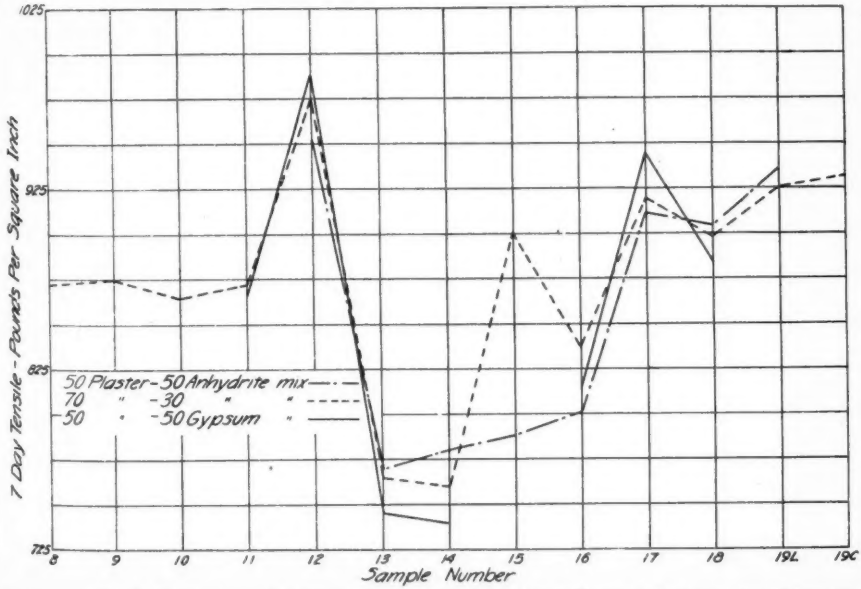


Fig No. 7 - Comparative Strength of Cement Having Different Mixtures for Retarder
Average Strength of Samples Containing 1.50% - 2.00% SO_3

as possible, that is, carefully control the temperatures of the mill and adjust the feed so that a product of uniform fineness will be obtained.

3. Determine the amount of SO_3 as plaster of Paris which, when ground with the clinker in the tube mill will give proper retardation; also determine the maximum strength obtained by using this form of retarder. (Maximum SO_3 content to be kept at 2 per cent.)

4. Note the effect of varying percentages of gypsum as such on the clinker.

5. Add increasing percentages of gypsum to the clinker, grinding in the tube mill, in the usual manner, so as to determine the minimum amount required to produce a cement having a normal set, and also the percentage necessary to produce the maximum strength. (Test these mixtures soon as possible.) If gypsum as such does not retard the clinker, a comparison between the minimum SO_3 content obtained here and that obtained under (3) will give a close estimate of the amount of gypsum calcined in the tube mill, and if this percentage of SO_3 is either greater than that obtained in (3) or less than the minimum percent in (4) it will show that at least some of the gypsum was calcined even though the gypsum as such did have some effect as a retarder.

6. Run a series of tests using mixed retarders. First add a sufficient amount of gypsum to produce a cement having an SO_3 content equal to that which was found under (5) to have the maximum strength. Then, keeping the total SO_3 content the same, use increasing proportions of anhydrite in the retarder until a point is reached where the cement either becomes quick setting or begins to decrease in strength. This will give the maximum proportion of anhydrite which may be present in the retarder as long as the total SO_3 content of the cement remains at this percentage.

If it is found impossible to add any anhydrite to this retarder without injuring the quality of the cement it would simply show that a larger amount of retarder is required when anhydrite is present and consequently its use would not be advisable.

Advantages of Using a Mixed Retarder

The advantages that may be obtained by the use of the mixed retarders, gypsum and anhydrite, will depend somewhat upon the conditions which exist at each individual plant. However, three possible factors in its favor will at least justify further investigation. First, the possibility of obtaining mixed retarders more economically; second, the advantage which would be gained by finding a wider utilization for mixtures of anhydrite and gypsum which are encountered in some gypsum deposits; and third, the advantage of obtaining a retarder which has little possibility of changing enough during storage to effect the time of set of the cement.

The Clinchfield Portland Cement Company has already conducted a large number of commercial tests on the use of mixed retarders at their Kingsport, Tennessee, plant. The author was permitted to witness their last series of tests, and this exceptional opportunity connected with the information gained by visiting several cement plants in the Lehigh Valley district has been of unusual value in the interpretation of the results obtained by this laboratory investigation.

Conclusions

1. As long as the composition of the clinker is kept within the limits necessary to produce a satisfactory portland cement, neither the individual properties of the clinker nor its reaction with the different forms of retarder can be predetermined by a study of clinker composition alone. However, a detailed study of the constitution of the clinker and complete knowledge of the conditions maintained during each step in the process of its manufacture, along with a study of the physical and chemical properties of the resulting cement, would go a long way toward determining the best type of portland cement which it is economically possible to produce, and would open the way for elimination of variations in the properties of different cements.

2. For all the samples which were tested in this investigation, plaster of Paris was the most efficient form of retarder, and it is the only form which is certain to retard all samples of clinker as long as the maximum SO_3 content of cement is maintained 2.0 per cent. However, the high cost of this material along with the fact that it often makes a quick setting cement before there is sufficient SO_3 present to produce the strongest material, shows that the plaster should make

up only that portion of the SO_3 content which is needed for proper retardation of the clinker.

3. When gypsum, as such, is used as a retarder a larger percentage of SO_3 is required than when plaster is used, and in some cases it does not retard the clinker at all. Furthermore, wherever it may be used, a larger amount of mixing water is required to produce a normal consistency, and consequently the strength of the cement is proportionately weaker. All evidence available points to the fact that when gypsum is ground in the tube mill with clinker more or less plaster of Paris is produced during the grinding process, and therefore a mixed gypsum-plaster retarder is obtained.

4. Anhydrite, when used alone as a retarder, failed to produce a satisfactory cement with any of the twenty samples of clinker tested. A large amount of mixing water was required; it retarded only those samples of clinker which were of themselves slow setting, and the cement containing this form of retarder was, as a rule, weaker than that which had be retarded with any other form of calcium sulphate.

5. The use of mixed retarders (anhydrite and plaster or gypsum and plaster) produces a more satisfactory cement than can be obtained by the use of any one form of calcium sulphate alone, but it is necessary for the mixture to contain enough SO_3 as plaster to retard the clinker if the best portland cement is to be obtained.

6. The value of mixed retarders is practically independent of the form of calcium sulphate used as long as there is sufficient SO_3 present as plaster of Paris to retard the clinker. This latter conclusion, however, is based on the results obtained in laboratory tests, and consequently mill tests must be conducted to determine whether a mixed retarder can safely be used in the manufacture of portland cement.

Climax Appoints

The Climax Engineering Company, Clinton, Iowa, announces the appointment of T. L. Keeling as sales representative with offices at 657 Leader Building, Cleveland. Mr. Keeling will have charge of the sale of Climax Trustworthy engines in Ohio, western New York and western Pennsylvania.

Eliminating A Nuisance

From time to time consideration has been given to the condition of open-top cars, furnished for the transportation of sand, gravel and crushed stone, with a view to securing from railroads, cleaner cars, thereby saving the producer the cost of cleaning cars, and eliminating the detention incident to the delay involved in the cleaning of cars.

Following conferences between various committees and the railroads, it has been agreed that as a practicable proposition the first step in securing relief from the existing situation will be to require consignees to completely unload cars, and to remove any blocking, bracing, or debris used in connection with, or resulting from, the lading. Railroads have demonstrated their sincerity in attempting to cope with this situation but require assistance.

To accomplish that end it has been agreed that if consignees will make a written report, in detail, to the proper transportation officer, i. e., Superintendent of Transportation, or Superintendent of Car Service, of the railroad furnishing cars, showing specifically the initial, car number, date and nature of the debris in all cars tendered for loading, making them unsuitable for use in transporting your produce, the matter will be taken up with the last consignee, and an attempt made to correct the situation.

New Foreign Office

The Allis-Chalmers Mfg. Co. has opened a new district office in Lima, Peru, in charge of Mr. W. G. Bolton. This office, as well as the one at Oruro, Bolivia are a branch of the company's office at Santiago, Chile, of which Mr. W. R. Judson is Manager. The Oruro office is in charge of Mr. P. G. Gilliard, succeeding Mr. Erling Winsnes, who has returned to the United States.

Linde Changes

At the last meeting of the board of directors of the Linde Air Products Company Mr. G. W. Mead, formerly president was elected chairman of the board. Mr. W. F. Barrett, formerly vice president was elected to the presidency. In addition to these changes Mr. R. R. Browning was elected vice president in charge of sales activities and Mr. J. A. Rafferty, vice president in charge of engineering, manufacturing and research.

Plastic Magnesia Research

METHODS of making satisfactory plastic magnesia, used extensively in the manufacture of stucco and composition flooring, from the magnesite deposits of the Western States have been developed as the result of an investigation conducted by the Bureau of Mines, Department of Commerce. The investigation also revealed that plastic magnesia of fair quality could be produced from dolomite, a material cheaply obtainable in the Eastern States, where the market for plastic magnesia is largest. The experimental work of the Bureau of Mines was conducted with magnesite from Washington and California, with the view of aiding American producers in establishing a domestic industry to compete with material heretofore largely imported.

The first commercial use of magnesian cement was in Germany, the Bureau of Mines points out in a report just issued. Their use in the United States was just being established at the beginning of the World War, but is gaining rapidly at present. Most of the plastic magnesia now made from domestic magnesite comes from California producers.

Magnesia stucco has gained headway in competition with cement stucco largely because it makes a stronger, harder and more elastic cement which adheres more firmly to wood surfaces and takes and holds dashes of ornamental colored pebbles as well as other stuccos. This stucco gives a house a more finished appearance, probably due to the colored pebbles, but it has one disadvantage—it is not as weatherproof as cement stucco. Weatherproofing compounds are therefore being tried. The structural firmness and density of the stucco are the qualities that best insure protection, and these qualities largely depend on the quailty of the plastic magnesia used, which in turn depends mainly on selecting suitable raw material and accurately controlling the proper calcining temperature. Judged from the cumulative experience of the industry, properly made magnesian stucco is resistant enough to weathering to be considered entirely satisfactory.

Composition floors, if properly laid, are quite satisfactory. They are permanent, warm to the touch, elastic, fireproof and fairly ornamental, and can be laid over old or new wooden floors. Bathroom floors and walls are now quite often covered with the composition and bathtubs are frequently encased in it. Slabs of the same material, often appropriately tinted, are used for drainboards in kitchen sinks and for similar purposes.

Interior plaster made with plastic magnesia offers a field as yet little exploited. Others uses for the material will doubtless develop. At present manufacturers of composition flooring and of stucco buy plastic magnesia and prepare mitxures that are ready to be moistened with magnesium chloride solution at the point of application. Formerly the supply of plastic magnesia was variable and occasionally bad, but this condition is now rapidly improving.

Recarbonation of free lime in burned dolomite or plastic magnesia, in order that these materials will yield satisfactory magnesian cements, has proved of great value for dolomites, but of doubtful value for magnesites, although they are benefited to some extent.

The big centers of consumption of plastic magnesia are in the Eastern States, whereas the only producing districts of the country are in California and Washington. On the other hand, large supplies of good dolomite are available in the East and the Bureau of Mines tests have shown that recarbonated dolomite makes very satisfactory stuccoes. Dolomite does not contain enough magnesia for flooring cements. However, since 80 per cent of the plastic magnesia sold is used for stucco, recarbonated calcined dolomite could satisfactorily supply most of the demand for plastic magnesia.

Research undertaken to show the suitability of Washington crystalline magnesite for the manufacture of plastic magnesia, while accomplishing its purpose definitely and satisfactorily, incidentally discovered a process for using dolomite in magnesian mortars which may well prove commercially important. This discovery indicates a use for vast deposits of pure dolomite near eastern consuming centers and may revolutionize the magnesian mortar industry.

The results of this investigation are contained in Bureau of Mines Bulletin 236, "Plastic Magnesia," by Oliver C. Ralston, Robert D. Pike, and Lionel H. Duschak, copies of which may be obtained from the Superintendent of Documents, Washington, D. C., at a price of 30 cents.

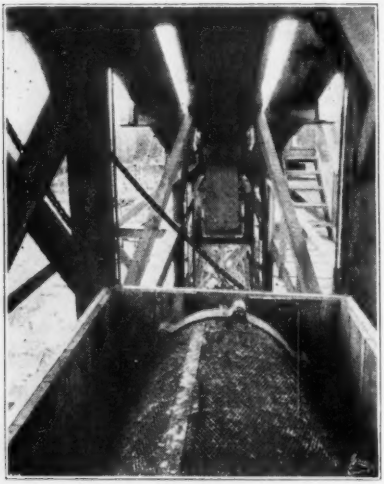
An Efficient Material Handling System In This Garnet and Silica Sand Plant

GROVEMONT, North Carolina, is developing fast as a popular resort town. It is in the very heart of the southern resort country and only a short distance from Asheville. It is while this new town of Grovemont was being laid out that an unusual deposit of garnet and silica sand was discovered. The discovery of this deposit came at a time when the market was just being created through the development of this territory into a millionaires' playground. When this rich deposit was discovered, Mr. E. W. Grove interested two or three others and organized the Grove Stone & Sand Company for the purpose of erecting a plant and marketing the garnet and silica sand available in this valuable deposit. One of the interesting plans in connection with the method of operation was in the development of the beautiful lake with pure, clear water, to a depth of from ten to twenty feet, as a result of excavating material.

The deposit lies in a natural basin between mountain ridges and clear water for washing is always available. A model 32 Marion excavator digs and loads the material into four yard side dump cars. These cars are then hauled to the washing and screening plant by a seven ton Plymouth gasoline locomotive. The plant building consists principally of three main structures with the necessary connecting belt conveyors. The first of these buildings is a primary screening and crushing plant where the oversize boulders, running often as large as eighteen to twenty inches in diameter, are reduced in size. The

The Trestle and Track to The Preliminary Crushing Plant

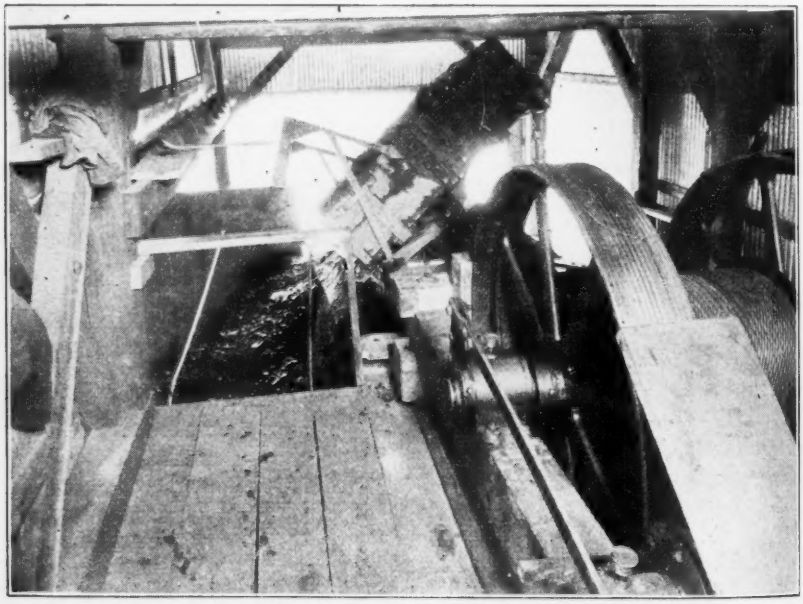
Excavating Material at Grovemont



One of the Washing Screens. The Belt Conveyor Delivering To Plant May Be Seen Above

second of these buildings is a secondary screening and crushing plant and here the rock is given its final crushing and sizing. The third structure is the washing and screening plant and also includes the main loading bins. Tracks for loading run beside each of the three main buildings and cars can be loaded by gravity of any size or mixture of sizes. The loaded cars are hauled one by one up an incline track to the top of the crusher house by means of a Stephens-Adamson double friction hoist with a 24x24 inch drum. This hoist is driven by a 40 h.p. Westinghouse motor and ⅝-inch steel rope is used for hauling. The material is quite wet when loaded into the cars but by the time the cars have been hauled up the incline the material has been drained sufficiently for the crushing and screening process. The cars upon being hauled up the incline are dumped into a hopper.

The material is fed from the hopper onto an incline bar grizzly by a Stephens-Adamson self-contained pan feeder which is 24 inches wide and 5 feet 2 inches long. The depth of the material on the feeder is regulated by Stephens-Adamson swing handle regulators which will swing up to let large boulders pass. Material under two inches drops through the incline bar grizzly onto the first belt conveyor below. The oversize material is discharged into a 14-inch McCully crusher, which reduces the stone to two inches. This crusher is driven by a 50 h.p. Westinghouse motor. The material dropping to the belt conveyor is carried up a 37⅞-inch slop to the scalping screen. This belt conveyor is carried up a 37⅞-inch slope



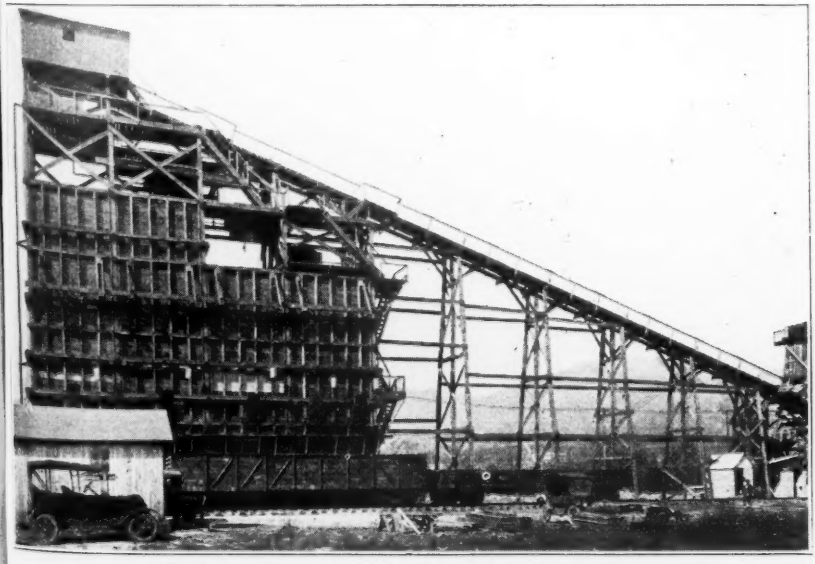
Interior View of Primary Crushing House.

long and travels upon Stephens-Adamson unit ball bearing carriers. A 20 h.p. Westinghouse motor drives the screen and belt conveyor, and also drives the feeder through the belt conveyor tail pulley.

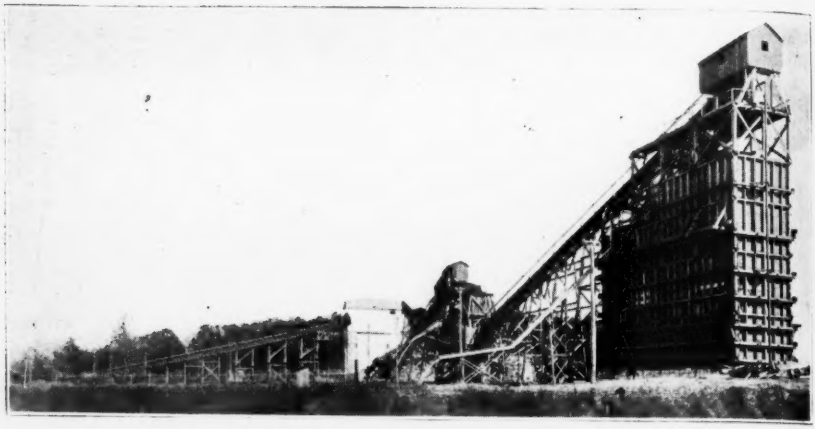
The scalping screen is a Stephens-Adamson revolving cylindrical screen, 42 inches in diameter and 16 feet long. This screen passes sand and gravel to another belt conveyor which is 24 inches wide and 200 feet long. This conveyor also travels upon Stephens-Adamson ball bearing unit carriers and elevates at a slope of 3½ inches in 12 inches to the first of a battery of three 72-inch Gilbert screens. Correct belt tension is maintained by means of a Stephens-Adamson gravity takeup. A 25 h.p. Westinghouse motor drives this belt conveyor and the three Gilbert screens. The 1¾-inch stone separated by the scalping screen passes to one storage bin while the 2½-inch stone passes to another. The oversize stone is discharged to a 6-inch high speed McCully crusher which is driven by a 25 h.p. motor below. This 1¾- and 2½- inch stone passed to the bins is ready for loading. The rock crushed by the 6-inch McCully crusher falls to a short belt conveyor, 24 inches wide and 103 feet long, and is elevated on a slope of 4½ inches in 12 inches to the first belt conveyor in the plant.

Feeder Below Car Dump. The Inclined Bar Grizzly Takes Boulders to Crusher.

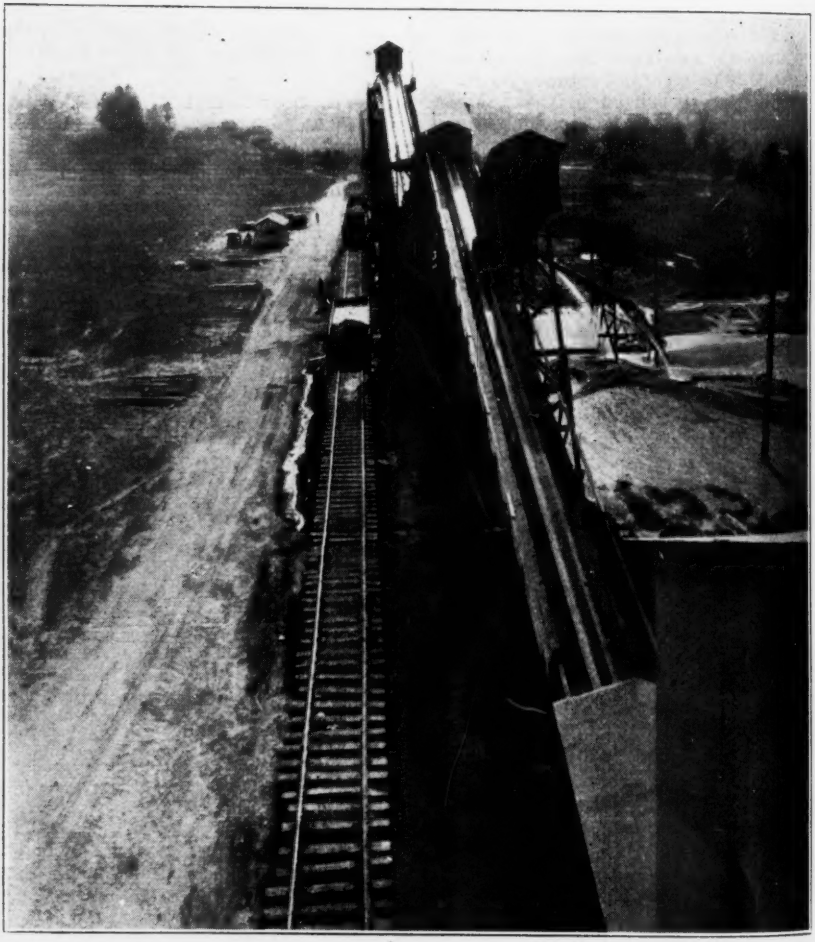
The Gilbert screens separate out three sizes of gravel, ⅜, ¾ and 1¼-inch, into bins ready for loading. The sand and wash water pass into a Stephens-Adamson settling tank which allows the clean sand to discharge into the bin below while the dirt, loam and foreign material are washed away with the dirty water. Cars are loaded from the storage bins by gravity through Stephens-Adamson



The Screening, Washing and Loading Plant.



General View of the Plant.



Belt Conveyor to Preliminary Screening Plant.

Building in Foreground is For Preliminary Crushing. At the Right is The Incline For the Dump Cars.

Looking From The Washing and Screening Plant Down The Belt Conveyor From The Scalping Screen.

quadrant pin gates which are equipped with counterweighted steel chutes. Similar gates on the other side of the bins load trucks and wagons. The product produced is an excellent quality of sharp garnet and white sand. Natural boulders are frequently sold for building stones. A thousand gallons of water per minute are used in the washing process. A Cameron pump is used. Electric motors totalling 215 h.p. furnish the power for operation. 1,200 tons of material are loaded per day, at the rate of about 120 tons per hour. All of the material handling and screening equipment were furnished by the Stephens-Adamson Manufacturing Company.

Every feature of the plant is modern in every respect and the material handling system being used is especially efficient. The Grove Stone and Sand Company, in serving a market which demands quality as well as quantity, is assured of carrying on a profitable business. Mr. E. W. Grove is president of the company. Mr. W. R. Ellerson is vice president. Mr. A. A. Hegeman is treasurer and Mr. G. C. Buquo is secretary and general manager.

Link-Belt Fiftieth Anniversary

Fifty years have passed since the incorporation of the Ewart Manufacturing Company, the forerunner of the present Link-Belt Company, in 1875. In commemoration of the fiftieth anniversary, the Link-Belt Company has published an attractive book entitled, "Link-Belt 1875-1925."

In this book it is mentioned that the patent of William Dana Ewart, a young implement dealer, from Belle Plaine, Iowa, for the detachable link chain, was dated September 1, 1874. Mr. Ewart first started to build a self binding harvester, but he realized the great need in such a machine for a detachable chain drive that could be repaired in the field; and he worked out the idea of a chain drive, the links of which could easily be replaced by the farmer, who up to that time had been wasting much time in going back to the barn or blacksmith shop for necessary repairs to the "strap-link" chain drives that were used on some of the first crude binders; or trying to adjust the flat belts, which stretched and tightened under varying conditions of heat or moisture in the field.

Late in 1874 when Mr. Ewart came to Chicago with a view to arousing some interest in his "detachable link chain," he succeeded in interesting John C. Coonley, a lawyer who was then President of the Chicago Malleable Iron Company. As a result a company was duly incorporated in 1875, under the name of the Ewart Manufacturing Company, for manufacturing detachable link chain. In 1876, the Ewart chains were exhibited at the Philadelphia Centennial.

New uses for the invention developed rapidly, and in 1880 the Link-Belt Machinery Company was incorporated "to design, build, and supply accessory parts, and install elevating and conveying machinery employing Ewart Chains," the plant for this company was built in Chicago.

In 1888 the Link-Belt Engineering Company was formed with a plant in Philadelphia. These two plants found increasing numbers of new uses for the chain, with the result that all three plants continued to grow in size until in 1906 a consolidation of the three interests took place, and Charles Piez elected President.

It will be remembered that Mr. Piez was Director General of the Emergency Fleet Corporation during the World War. Mr. Piez is now Chairman of the Board of Directors, and Alfred Kauffman, formerly Vice-President in charge of the two Link-Belt plants in Indianapolis, is now President of the Company.

From the humble beginning in 1875 this company now operates and owns ten large manufacturing plants, with seven shops and warehouses, and twenty-seven branch offices, and its products now include elevating and conveying equipment for all kinds of materials; complete equipment for the handling and cleaning of coal, on the ground and in the boiler house, complete coal tipples and coal washing plants, sand and gravel washing and preparing plants, sand preparing and conveying machinery for the modern foundry, locomotive and crawler type cranes, silent chain drives for industrial plants, and for the front end of the automobile—in fact, Link-Belt today builds complete equipment for conveying, handling and power transmission.

Operating Two Crushed Stone Plants In Place of One Large Plant

OPERATING two crushed stone plants in two different states enables the John W. Karch Stone Company to take advantage of many market situations to advantage. Each has its local business and when market conditions are not the best at one plant they are usually compensated by good conditions at the other. One state may be slow in its highway program but then the other may be stepping right along. There have also been times when one plant has had more orders than it could handle. The second plant was able to take care of the situation. It rarely happens that poor market conditions, a surplus of orders, a serious breakdown, a freight tie-up, labor trouble, etc., affect two different plants in two different states at the same time. There are indeed many advantages in operating two such crushed stone plants as the John W. Karch Stone Company does. One of these plants is five miles west of Celina, Ohio. The other plant is located near New Corydon, Indiana.

The plant near Celina, Ohio is working a deposit of gray limestone of which 47 acres is owned by the Company. A Marion model 20 Steam Shovel with a 1¼ yard bucket loads the stone into Koppel dump cars. These cars are hauled to the crushing and screening plant by a Minster 7 ton gasoline locomotive which is equipped with a Buda engine. The crushing is all handled by a number 3 and a number 6 McCuly crushers. Screening is taken care of by a 32 inch by 16 foot Allis Chalmers rotary screen. The material is elevated by a Good Roads elevator which handles about 600 tons per day. The plant has storage capacity for 300 tons and the plant capacity is 500 tons per day. A 125 h.p. Buckeye oil engine using fuel oil furnishes the power. This engine consumes 65 gallons of oil per day and requires about 2 quarts of lubricating oil per day. The power costs are unusually low. The material is shipped largely by truck. The truck fleet consists of four 5 ton Gram Bernstein, one 2 ton International and one 7 ton Sternberg. Water is supplied by a 6 inch Gould pump and by a 6 inch American pump.

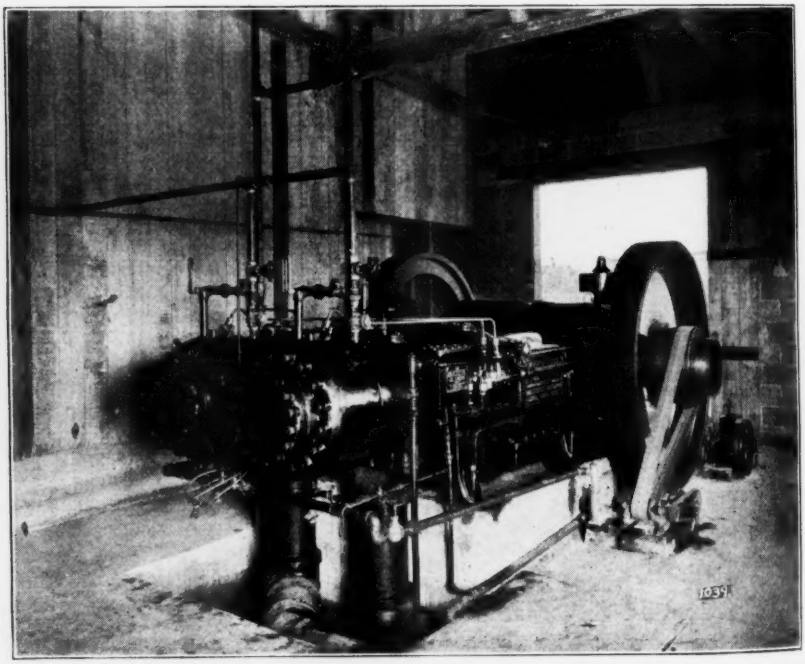
The second plant at New Corydon, Indiana, is located on an 85 acre deposit of gray limestone. A Marion model 21 gasoline electric shovel with a ¾ yard bucket loads the stone into Koppel dump cars. These cars are hauled to the crushing and screening plant by an 8 ton Minster gasoline locomotive. The crushing plant consists of one number 4 and one number 7½ Kennedy Van Suan crushers. The 60 inch by 24 foot screen and the elevators were also furnished by Kennedy Van Saun. The capacity of this plant is 1000 tons per day with storage for 500 tons. Water is supplied by a 4 inch Gould pump. A 190

The New Corydon, Indiana, Plant.

The Celina, Ohio, Plant.

h.p. Buckeye oil engine furnishes the power for this plant also. This engine is running ten hours a day and in that time consumes 105 gallons of fuel oil and requires only one gallon of lubricating oil per day. All material that is moved by truck is done so under contract.

The stone from both plants grades high and meets the specifications of the respective highway departments. Here we have two separate plants with a total capacity of 1500 tons per day. That tonnage would require of a single plant probably larger units than are at present working in either plant. The John W. Karch Stone Company believe it is more economical to conduct two separate operations such as they do. This belief, added to the factor of safety resulting from distributing the capital over two plants located where existing conditions are somewhat different, have settled the company on a policy to continue as they are now operating. Expansion will come by other units rather than by increasing the capacity of either plant materially.



The 190 H.P. Oil Engine At The New Corydon Plant.

An Emergency Sand and Gravel Plant

EMERGENCY or temporary plants are frequently built in the sand and gravel industry, but in nearly all cases they are built to fill a temporary demand for material. If not abandoned, they seldom develop into anything worthwhile. The Madison Sand and Gravel Company has built an emergency plant for the principal purpose of affording an opportunity to study its problems in order that a larger and thoroughly efficient plant may be built later. This temporary plant is simple, efficient and economical. There are some interesting innovations in connection with the plant system.

Mr. John G. Carpenter, the president of the Madison Sand and Gravel Company and the prime mover in this enterprise, had never seen a trade journal or a catalogue of equipment concerning the sand and gravel industry prior to the fall of 1924. At the close of the world war he had considered developing a sand and gravel deposit near Avon, New York, but the organizers of the Valley Sand and Gravel Corporation "beat him to it" on this same deposit. Mr. Carpenter watched the development of this operation and others and finally decided to start. An excellent deposit was secured at Avon, New York. Mr. H. O. Whitnall, a professor of geology at Colgate University, was interested and became treasurer of the company. Late in 1924 Mr. R. E. Brooks also became associated with the enterprise. None of these men had any real experience in the operation of a sand and gravel plant, but they immediately began to study their deposit and the different methods of plant construction employed by other operators in the state of New York. The more this study progressed, the more complex became the problem. Considerable construction work was going on in the vicinity, however, and more was planned, and in order to secure and hold some of these jobs it was decided to build a temporary plant for about three months' operation.

A crushing plant consisting of a 9x16 Champion jaw crusher, an 18 foot elevator and a set of 40 ton Acme portable bins was purchased. A four cylinder 50 h.p. Wisconsin gasoline engine was then secured for power. These units were set in line along the foot of the deposit and the elevator lengthened to 24 feet. An 11 foot 14 inch belt conveyor running at right angles to the crusher was installed next. The material was brought from the deposit to the plant by teams with a drag scraper. The discharge was to a grizzly with bars 4 inches apart. The material dropped through this grizzly to a hopper of 2 yards capacity. The belt conveyor carried the material from this hopper to an inclined grizzly with bars spaced 1¼ inches apart. The sand and gravel passing through this grizzly dropped directly into the bucket elevator.

The oversize was picked out by hand and thrown into a chute which fed the

The Screening and Washing Plant.

The Hoist Operating The Drag Scraper.

crusher. The bucket elevator lifted the sand and gravel which passed through the grizzly to a box 16x20x12 inches. The material was washed from this box by a 12-inch stream along a chute into the screen. This screen head had a 12-foot solid section which was converted into a scrubber by bolting in about a dozen angle iron buffers. These angle irons were about 15 inches long and were set at such an angle that the material was held back. Two 2-inch pipes with the ends flattened sprayed into the end of the screen. Later in the summer another 2-inch pipe with a perforated T was inserted in the dewatering box about a foot above the bottom for occasional use or when there was an excess of sediment or fine sand. The sand which was flumed into cars was dewatered by a homemade tank. The top of this tank was 18x24 and 30 inches deep. Mr. C. A. Adams, formerly with the J. E. Carroll Sand Company, became plant manager in August of this year and designed this tank. A new automatic device for emptying the tank was installed, and the system proved to be efficient.

The screen is 30 inches by 14 feet and a 5 foot ¼-inch sand jacket was added to carry the material along and permit the use of two sections of the bin for sand. The main screen had ¾, 1½ and 2¾ inch perforations. Chutes were arranged to carry each size into separate sections of the bins. A chain carrier returns the number 3 and oversize to the crusher. Cars are loaded by sluicing the stone and

The Crushing Plant.

sand in iron troughs over a distance of 40 feet to the cars. The chutes under the screen are removable and so arranged that any size material can be loaded either separately or as a mixture. Sand and stone can be loaded at the same time by sluicing to one side about sixty feet by troughs which are made of 18-gauge metal and shaped like an eaves trough.

There was a space of about 3 feet between the bottom of the screen and the top of the bins. To take care of this a box 6 feet long, 30 inches wide and 30 inches high of 1⅝-inch pine was made. The front side was vertical and the back side was sloped toward the front enough to make the bottom of the box 8 inches wide. The purpose of this construction was to have the box extended under the screen and also to the outlets near the side of the bins where they would be accessible to the operator from a platform which was built on the side of the bins. Six 3-inch valves were inserted in the bottom of this box to draw off the sand. The box was found to be too long and two wooden partitions were inserted making it 3½ feet long. The box was set parallel to the screen and the sand laden water poured into the front end of the box and the waste water released to a wooden trough at the other end.

Stripping was first accomplished with a Fordson and an automatic scraper. Overburden from 18 inches to 2 feet of heavy stone was removed. A ¾-yard Gren scraper operated by a Lidgerwood hoist was installed in August for excavating. A Fordson was used as a power unit, and the maximum radius for the scraper was kept within 200 feet. The water for washing purposes was supplied by a 5-inch Gould centrifugal pump operated by a 15 h.p. gasoline engine. The pipe line is 4 inches.

The initial operations produced 75 tons per ten hour day, and the installation of the drag scraper increased this capacity to 150 tons. This little plant has delivered 200 tons per ten hour day when necessary. The plant was designed for three months' operation, and this will account for the mistakes and changes. As a business proposition for a year it would probably not be a worthwhile enterprise. It did, however, serve its purpose and has been a profit as well as an educational activity. It has enabled the Madison Sand and Gravel Company to solve some problems which would have meant costly mistakes had they built a permanent plant hastily. It also enabled the company to introduce its material to the market in a critical emergency. The foundations for a much larger and a permanent plant are now in place. The new plant will be ready for spring delivery, and in the course of the next few months the readers of Pit and Quarry will have an opportunity to read of what this emergency plant has developed.

A 12-Inch Swintek Nozzle Being Shipped to the Rhodes Jamieson Company of Oakland, California From Eddyville, Iowa.

Crushing Trap Rock at Cromwell Quarry

SITUATED on the main road between Middleton and Berlin, Connecticut, four and a half miles to either place will be found the Cromwell Quarry Company's crushed trap rock operations. The site of this plant is known as Cromwell. While the operation is small, it is efficient and profitable, and the Cromwell Quarry Company is rendering a distinctive service to its territory. The company is incorporated with a capitalization of $50,000 and with an economical plant investment is producing on an average 200 tons of crushed trap rock per day, which is marketed entirely by truck within a radius of ten miles from the plant.

Drilling operations are conducted with a Sullivan mounted hammer drill, and 1¼ inch hollow steel is used. As much as a 100 feet in a 10 hour day has been drilled with this machine. A 10x10 Ingersoll Rand compressor supplies the air. This compressor is driven by a 60 H.P. Waukesha gasoline motor through a counter shaft and two belts on the compressor. Goodyear rubber belts are used throughout the plant. A Thew steam shovel loads the stone into side dump cars which are drawn by horses over narrow gauge track to the crushing and screening plant.

A number 6 Champion jaw crusher does all the crushing. This crusher is driven by another Waukesha gasoline motor, but this is a 75 H.P. motor and drives through a counter shaft and a double belt to the crusher. The discharge from the crusher is elevated by a Reliance bucket elevator, which is mounted on a single chain, a height of 48 feet to a 22x36 inch Reliance screen which is equipped with a wire dust jacket. The screen discharges direct to storage bins of 550 tons capacity.

The Crushing and Screening Plant Showing the Railroad Approach to the Plant.

The officers of the Cromwell Quarry Company are Henry M. Petrofsky president, Joseph H. Petrofsky vice president, and J. W. Petrofsky secretary-treasurer. These officers constitute the Board of Directors.

The Plant of the Cromwell Quarry Company.

Keeping the Cost of Sawing Marble

PROBABLY the most important item in the cost of producing a finished product of marble is in the preliminary operation of sawing the large and heavy quarry blocks into smaller pieces of suitable size for subsequent operations.

This preliminary cutting is done by "gang-saws." A gang-saw consists of a number of smooth strips of soft iron held parallel to each other in a frame. The quantity of strips set in a frame is varied according to the size of the quarry block and the thickness of the pieces to be cut from it. As the saw moves back and forth, a stream of water containing sharp sand flows over the surface of the block so that the abrasive action of the sand under the strips of iron cuts the marble.

In the cutting mills of the Vermont Marble Company a cutting department consists of 32 gang-saws. There are several such departments and each one is operated as a separate unit. Every department is credited with the amount of work turned out by it and debited with the cost of production. This accounting is done by means of the series of cards shown in the accompanying illustrations.

Figure 1 is a reproduction of a card which is placed with each gang-saw, giving a complete record of what takes place at that machine. First comes the date when the quarry block was put in place. Under "Filled" is entered the time consumed in accomplishing this, and under "Set" is entered the time of starting and finishing the setting of the saws in the frame. Then follows the time when the machine was "started," the date and time when the bottom of the block was reached ("Bottomed"), and thickness of the cut ("Height") and number of saws. Under "Blocks" is

.....Vt., ...192.....

Charge .....Acct.

Credit .....Acct.

For..... Signed.....

MATERIAL

QUANTITY AND ITEMS	UNIT PRICE	EXT

LABOR

NAME OR NUMBER	HOURS	ALLOWED RATE	EXT

Figure 4.

GANG NO._____

_____MILL MONTH_____YEAR_____

Date	Filled	SET A. M.	SET P. M.	STARTED A. M.	STARTED P. M.	Date	BOTTOMED A. M.	BOTTOMED P. M.	Height	Saws	BLOCKS Des.	BLOCKS SIZE	REPAIRS Stop	REPAIRS Start	REPAIRS Des.	
																1
																2
																3
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																8
																9
																10
																11
																12
																13
																14

Figure 1.

Month Mill Gang Year

DATE	CLASS	Division	CUBIC	Block	Time Sawing	TIME BETWEEN FILLS	REPAIRS

Figure 2.

the column headed "Des." is placed the code designation for grade of marble in the machine which also indicates whether it is soft, hard or medium hard to cut and gives an idea beforehand how long this particular job is going to take. The time lost for repairs and the nature of the repairs ("Des.") are also shown. These entries are all made by the foreman.

In figure 2 is shown another card, also pinned up on the wall at each machine, which gives a summary of the information contained in the first card. These entries are made by a man from the cost accountant's office and give a daily record of the performance of each gang-saw. Under "Class & Division" are given the grade and kind of marble, under "Cubic" the number of cubic feet sawed, under "Block" the dimensions of the block and the time spent in sawing, the time between fills when the machine was idle and, finally, the time lost in "Repairs."

Figure 3 shows the card kept in the office on which are recorded the debits and credits for each gang-saw by means of the data from figure 2. The "Saw Setting Record" is the debit account; the "Sawing Record" is the credit account.

The slip used for obtaining material from the supply house or store room or when one department does work for another department is reproduced in figure 4. For instance, if the electrical department replaces a fuse for one of the gang-saw departments, they draw the fuse from the supply room. This is charged to the proper gang-saw and credited to the supply department on one of these slips. Another slip is then made out crediting the electrical department with the time spent in clearing the trouble and debiting the gang-saw. This scheme of debits and credits is used throughout the plant.

1	2	Mill	A	B
		Gang No.		
		Date		

SAWING RECORD

Division	Size of Blocks	Cubic	Rate	AMOUNT

Figure 3.

Gas or Electric Hoists and Derricks

Available for immediate shipment f. o. b. New York, Chicago, Philadelphia, Pittsburgh

GASOLINE OR ELECTRIC HOISTS

Large quantity American double drum hoists with attached swinging gear, capacity 6000 lbs. on single line at 162 ft. per minute with—new 55 H.P. Climax gasoline engine—37 H.P. 220 or 440 volt, 60 cy., 3 ph., A.C. electric motor —35 H.P., 220 volt, D.C. electric motor—or without power for belt drive.

2—52 H.P. single drum Lidgerwood, with 220 volt, 60 cy., 3 ph., A.C. motor, complete with one winch head.

1—75 H.P. double drum Clyde concrete tower hoist, capacity 10,000 lbs. on rear drum, 5,000 lbs. on front drum, with 220 volt, 60 cy., 3 ph. motor.

CRANES

1—15-ton O & S, 8-wheel M. C. B., 40-ft. boom, bucket operating.

1—Type "B" Erie Combination Shovel and Crane, mounted on caterpillars.

1—O & S 7-ton Crane, 30-ft. boom, ¾-yd. clamshell bucket, traction wheels.

1—Byers Auto Crane, 30-ft. boom, ¾-yd. bucket, traction wheels, steam.

STEAM HOISTS

12—Three-Drum Hoists, with or without boilers. Sizes 10x12, 9x12, 9x10, 8¼x10 and 7x10, with separate swingers for derrick work. All makes.

54—Two-Drum Hoists, with or without boilers. Sizes 12x12, 10x12, 9x10, 8¼x10, 7x10, 6¼x10, 6x8, and 5x8. Can be equipped with holding drum for bucket work.

DERRICKS

Large quantity late model American Stiff Leg Derricks, mast 14x14x40 ft., booms 14x14x60 ft., stiff legs 14x14x50 or 60 ft., sills if desired, with 12 ft. steel bull wheel, for hook work or bucket operation.

Large quantity late model American Stiff Leg Derricks, mast 16x16x40 ft., booms 14x14x80 ft., trussed with hog rods, legs and sills 14x14 with 16-ft. steel bull wheel, arranged for hook or bucket operation.

Also several Guy Derricks, wood or steel.

STEAM SHOVELS

3—78C late '23 models, 30-ft. boom, 19-ft. dipper stick, 3-yd. dipper, one on railroad trucks, two on caterpillars.

LOCOMOTIVES

3—Porter, 36-in. ga., 18 ton, saddle tank, 10x16 cylinders, rebuilt like new. Nos. 4619, 4667, 6804.

1—Davenport std. ga., 20 ton, 10x16 cylinders, saddle tank. No. 1497.

2—Porter std. ga. saddle tank, 14x22 cylinders, weight 42 tons, like new, only one year of service, shop Nos. 6770, 6853.

3—7 ton, 24-in. ga., Plymouth, gasoline.

6—3 ton, 24-in. ga., gasoline. 3—Plymouth. 3—Whitcomb Fordson.

Equipment Corporation of America

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860 Empire Bldg.
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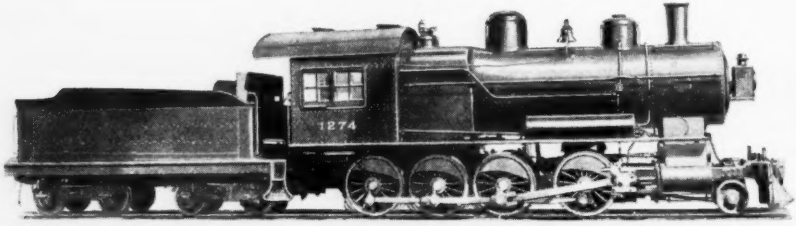
CHICAGO, ILL.
1460 Roanoke Bldg.
Phone Randolph 6586

PHILADELPHIA, PA.
660 Land Title Bldg.
Phone Rittenhouse 5498



3 Duplicate; 82-Ton; 20x26" Consolidation Type; Piston Valve; 200 Lbs. Steam; 48" Wheel Centers; Tractive Power 34,000 Lbs.; Thoroughly Overhauled; I. C. C.

ALSO HAVE OVERHAULED AND READY—

5—75-Ton; 20x26" Consolidations; 44" Wheel Centers; 190 Lbs. Steam; Tractive Power 33,590 Lbs.; I. C. C.

3—85-Ton; 20x26" 12-Wheel Consolidations; Piston Valve; 48" Wheel Centers; 200 Lbs. Steam; Tractive Power 34,000 Lbs.; I. C. C.

4—92-Ton; 21x28" Consolidations; Piston Valve; Wide Firebox; 200 Lbs. Steam; 50" Wheel Centers; Tractive Power 38,000 Lbs.; Some Outside Valve Gear; I. C. C.

1—125-Ton Shay Geared; 200 Lbs. Steam; Tractive Power 53,000 Lbs.; I. C. C.

1—60-Ton; 1924" 6-Driver Saddle Tank; New Asme Boiler in 1921.

WILL EXCHANGE FOR LIGHTER POWER, ETC.

Have other equipment overhauled and ready

—RELAYING RAIL—

Southern Iron & Equipment Co. **Atlanta, Ga.**

FOR SALE OR RENT

All equipment overhauled in our Shop is furnished in guaranteed condition, subject to thirty days' trial in service.

STEAM SHOVELS—Railroad Type

(Note:—All Railroad Type Steam Shovels can be furnished on full caterpillar mountings if desired.)

1—95-C Bucyrus. Shop No. 1235, 4-yd. or 5-yd. dipper.
1—Model 80 Marion. Shop No. 1312, 4-yd.
1—Model 75 Marion. Shop No. 2112, 2½-yd. or 4-yd. dipper.
1—70-C Bucyrus. Shop Nos. 1197, 2½-yd. dipper.
4—70-ton Bucyrus. Shop Nos. 920, 939, 977 and 1233, 2½-yd. dippers.
5—Model 60 Marion. Shop Nos. 1301, 1995, 1999, 2059 and 2238, 2½-yd. dippers.
2—60-C Bucyrus Shop Nos. 1286 and 1388, 2½-yd. dippers.
1—45-C Bucyrus. Shop No. 1201, 1¾-yd dipper.

STEAM SHOVELS—Full-Revolving

1—80-B Bucyrus Caterpillar Type Steam Shovel. Shop No. 4002—New November, 1923. Equipped with 41-ft. 6-in. boom, 26-ft. dipper arm and 2½-yd. dipper.
1—Model 36-Marion. Shop No. 4727, 1½-yd. dipper, Caterpillar.
2—Model 31-Marion. Shop Nos. 3341 and 3613, 1-yd. dipper. Traction wheel or railroad truck mounting.
1—18-B Bucyrus. Shop No. 1870, ⅞-yd. dipper. Traction.
2—Type "B" Erie. Shop Nos. 1484, 1880, Caterpillars, high lift, ¾-yd. dippers.
1—Type "B" Erie. Shop No. 559. New A.S.M.E. boiler. Standard boom, ¾-yd. dipper. Traction or railroad mounting.

SIDE DUMP CARS

10—30-yd. Clark All-Steel Dump Cars. Located Youngstown, Ohio.
2—20-yd. Western All-Steel Air Dump Cars, vertical cylinders.
7—12-yd. Western Air Dump Cars, 19-ft. beds, box girder doors.
10—12-yd. Western Air Dump Cars. 19-ft. beds, box girder doors. Vertical cylinders. located, Opeklika, Ala.
2—12-yd. Western Hand Dump Cars, 19-ft. beds, box girder doors.
29—12-yd. Western Air Dump Cars, Truss-rod doors, 26-ft. beds.
3—12-yd. Oliver Hand Dump Cars.
6—8-yd. Western 36-in. ga., double trucks.
10—6-yd. K. & J. Steel Sills, Truss-rod doors. Steel lined floors. Located Burnaugh, Ky.
17—6-yd. Western, std. gauge, wood sills, Truss rod doors, automatic couplers.
16—6-yd. Continental, std. gauge, Steel sills, truss-rod doors.
10—4-yd. Western Heavy Duty, 36 in. gauge, Steel lined floors.
51—1½-yd. Western, 24-in. gauge.

SPREADER CARS

1—Std. gauge Western Spreader Car.

STEAM SHOVEL PARTS

1—5-yd. Dipper for 95-C Bucyrus Shovel.
1—Boom for Marion 60 or 61 Shovel, length 35-ft. 22-ft. dipper arm, 1½-yd. dipper, long jack arms, etc.
1—19-ft. 6-in. boom. 12-ft. sticks and ditcher bucket for Type B Erie Shovels.
1—22-ft. dipper stick for Type B, Erie Shovel.

LOCOMOTIVES—24-in. Gauge

3—7x12 Davenport Dinkies. Shop Nos. 1202, 1411 and 1524. Weight 9 tons.
1—6x10 Davenport Side Tank Dinkey. Shop No. 1307. Weight, 7 tons.
1—7x12 Vulcan Saddle Tank. Weight 9 tons.
1—6-ton Whitcomb. Shop No. 1259. Gear drive. Gasoline.

LOCOMOTIVES—36-in. Gauge

1—9x14 Vulcan Dinkey. Shop No. 1675. Weight, 14 tons.
2—7x12 Davenport, 4-wheel Saddle Tank. Shop Nos. 1566 and 1567.
1—9-ton Whitcomb Gasoline Locomotive.

LOCOMOTIVES—Standard Gauge

1—19x24 Baldwin 6-wheeled S. T. Shop No. 49553, built 1918. Weight 67-tons, air brakes, 180 lbs. steam pressure.
1—16x24 Vulcan four-wheeled Switcher, with tender. Shop No. 1764. Steam pressure 180-lb. Weight 40 tons.
3—11x16 Davenport 4-wheeled Saddle Tanks. Shop Nos. 1938, 1939 and 1951. New 1923. A.S.M.E. boilers carrying 170 lb. pressure. Steam brakes.

DRAGLINE EXCAVATORS

2—Class 24 Bucyrus. Shop Nos. 858 and 859. Steam operated, skids, 100-ft. booms, 3½-yd. Page buckets, electric lights, coal hoists, Located near E. St. Louis, Illinois.
1—Class 14 Bucyrus. Steam operated. Shop No. 748. Caterpillars. 60-ft. boom, 2-yd. Page bucket.
1—Monighan No. 2. Shop No. 789. Skids. 60-ft. boom, 2-yd. bucket.
2—30-B Bucyrus. Shop Nos. 3640 and 3641. Caterpillars. 40-ft. booms, 1-yd. bucket.
1—Model 210 P&H Gasoline Dragline. Shop No. 1077 Armored caterpillars. 40-ft. boom, 1-yd. Page bucket.
1—Complete Caterpillar arrangement for Class 14 Bucyrus Dragline equipped with armored tread.

CRANES

1—Type "B" Erie. Shop No. 559. Traction or railroad truck mounting. 32-ft. boom. Bucket-operating.
1—10-ton Industrial, 4-wheeled. Shop No. 1989, 40-ft. boom, bucket operating.
1—15-ton Ohio. Shop No. 3441. 8-wheeled, M.C.B. trucks. 40-ft. boom, with 10-ft. extension, bucket-operating drums, 1-yd. bucket.
1—25-ton Browning, 8-wheeled. Shop No. 1560. 50-ft. boom, bucket-operating drums and 1½-yd. Mead-Morrison clam shell bucket.
1—Gantry Crane. New in 1919; 48-ft. boom, 15-ton cap., at 18-ft. radius; 7-ft. 10½-in. gauge, 12-ft. wheelbase, self-propelling. base of boom 17-ft. above track. Bucket-operating drums. Weight, 50 tons.

BUCKETS

1—1-yd. Class "M" Page Dragline.
1—1½-yd. Class "S" Page Dragline Bucket.
1—2-yd. Class "S" Page Dragline Bucket.
1—2-yd. Class "M" Page Dragline Bucket.
1—3½-yd. Class "C" Page Dragline Bucket.
1—¾-yd. Lakewood Clam Shell.
1—¾-yd. Williams Clam Shell.
1—1-yd. Browning Clam Shell. Reeved type.
1—1¼-yd. Williams Hercules Clam Shell.
1—1½-yd. Brown Hoist Clam Shell.
3—Mead-Morrison 1½ yd. Clam Shells.
2—1¼-yd. O. & S. Coal Loading Clam Shells.

MISCELLANEOUS

1—No. 7-S Knickerbocker Concrete Mixer, with power loader and water tank on trucks. New.
1—10-ton Buffalo-Springfield Roller. Shop No. 10707 with scarifier.
1—American Railroad Ditcher No. 459.
1—8-ft. Austin Road Grader.
1—6x10 D.C., D.D., Lidgewood Hoist, with 36x90-in. boiler.
1—6½x10 D. C., D. D. American Hoist, with butt strapped boiler.
1—7x10 D. C., D D. Lambert Hoist, without boiler.
1—7x10 D.C., D.D. Flory Hoist, without boiler.
1—Lambert 8½x10 Double Drum with boiler.
12—No. 8 Milburn Carbide Lights, 8,000 Candle Power.
4—No. 12 Milburn Carbide Lights, 12,000 Candle Power.
9—Milburn Reliance Carbide Lights, 1,000 Candle Power.
6—Milburn Builders Carbide Lights, 500 Candle Power.
1—No. 55 Buhl Portable Air Compressor.
11—No. 90 Buhl Portable Air Compressors. New.
1—20-hp. Upright Boilers.
1—50-B Bucyrus Boiler. Built by Johnston Brothers.
1—225-B Bucyrus Boiler. Built by Johnston Brothers.

FOR SALE OR RENT

STEAM SHOVELS

1—70-C Bucyrus. Shop No. 1749. Standard gauge, railroad, 2½-yd. dipper.

1—Model 60 Marion. Shop No. 1463. Standard gauge, railroad 2½ yd. dipper (butt strap boiler).

1—18B Bucyrus, revolving. Shop No. 1764. Traction wheels, ⅞-yd. dipper.

1—Type B Erie Revolving Steam Shovel, traction wheels, standard boom, ¾-yd. dipper.

1—Model 212 Marion (revolving). Shop No. 4620. Mounted on trucks, 55-ft. boom, 34-ft. dipper stick, 1¾-yd. dipper. Only used enough to be broken in; compares favorably with new.

1—Model 28 Marion, standard revolving. Shop No. 2804, traction wheels, ⅝-yd. dipper.

1—Little Giant Railway type, standard gauge, equipped with standard boom, 1¼-yd. dipper.

DRAGLINES

1—Class 210 P & H Gasoline. No. 1349, on caterpillars. 76-hp. Twin City Engine, 48-ft. boom, 1-yd. bucket.
1—Class 14 Bucyrus, steam operated, on caterpillars, 60-ft. boom, 2-yd. Page bucket.
1—Class 24 Bucyrus, steam operated, skids and rollers, 100-ft. boom, 3½-yd. bucket.
1—Class 24 Bucyrus Electric Driven, skids and rollers, 100-ft. boom, 3½-yd. bucket.

DUMP CARS

18—12-yd. Western Hand Dump Cars, Standard gauge.
35—1½-yd. Western, 24-in. gauge, Dump cars.

DIPPER

1—¾-yd. dipper complete for Model 18 Osgood Shovel.

FOR RENT ONLY

1—20B Bucyrus Revolving Steam Shovel, high lift. Shop No. 4390. Mounted on caterpilars; ¾-yd. dipper.

The above list is constantly changing. No matter what your machinery requirements are, write us—we may have it.

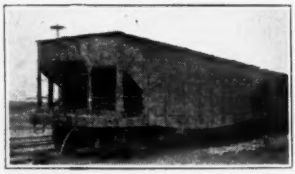
EARTH & ROCK EQUIPMENT CO.

534 National Life Bldg. Chicago, Ill.

Telephone Randolph 2580

FOR SALE

600—50-Ton All Steel Double Hopper Cars.
(400 have rolled steel underframes and 200 have pressed steel underframes)



Complete specifications upon request

BRIGGS & TURIVAS (Inc.)

110 South Dearborn Street, Chicago, Illinois

Railroad Cars and Equipment
Freight Car Parts
Relaying Rails and Fastenings

Scrapped Iron in all Its Forms
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Industrial Plants and Equipment

CRANES

1—TYPE B ERIE, full revolving Steam Crawler Crane. Shop No. 2600 new late 1923, ALL STEEL CATERPILLARS, A. S. M. E. boiler; 40-ft. crane boom, bucket operating; like new.
1—20-ton, 8-wheel, OHIO, Type "CD" Locomotive Crane, Shop No. 3631, new 1924, A. S. M. E. and Mass. boiler; 50-ft. boom; double drums, M. C. B. trucks used four months, guaranteed perfect condition.

DUMP CARS

36—4-yd. 36-in. gauge, WESTERN, two-way side Dump, new 1923, Heavy Duty, 4-pedestal, STEEL DRAFT BEAMS, box Girder, Doors overhauled, first-class condition.

Grey Steel Products Company
111 Broadway New York, N. Y.

CRUSHERS

1—36"x48" Traylor Jaw.
1—No. 9 Gates, manganese fitted.
1—No. 8 Gates, chilled iron fitted.
3—Symons Disc, 48", 24" and 18".
1—24"x36" Farrell.
2—24"x36" Carroll, manganese fitted.

SHOVELS

1—Marion Model 37 Electric.
1—Marion Model 32, caterpillar.
1—Erie, type B, combination.
1—Marion Model 28, two booms.

CRANES

1—22 ton O. & S. with 50 ft. boom.
1—Northwest Model 105, combination shovel and crane.
1—O. & S. 7 ton, gas, caterpillar.
1—10 ton Byers, traction.
1—10 ton O. & S. traction, 40 ft. boom.

BOLL MACHINERY CO.
140 So. Dearborn St., Chicago, Ill.

FOR SALE CHEAP

1—20-25 ton Industrial Locomotive Crane, D.D., A.S.M.E. boiler, 50-ft. boom, 8 wheel. Can be seen in operation now.
1—Vulcan 26 ton saddle Tank Standard Gauge Locomotive—12x16.
1—D.D. Meade-Morrison Hoisting Engine, 8¼x10.
1—Lidgerwood double drum Hoisting Engine 8¼x10 A.S.M.E. boiler new 1924, used 2 months.
1—¾ yd. Haiss Clam Shell Bucket.
3—Stiff Leg Derricks; bucket operation.
1—Hayward 4-Leaf O.P. Bucket, ¾-yd. cap. New.

HARRY C. LEWIS
156 Market St., Newark, N. J.
Mitchell 3678

CABLEWAY
800 ft. span cableway complete with Lambert engine.

HOISTS
5½"x 8" American D. C. D. F. D. with boiler.
7 "x10" D. C. D. F. D. with boiler.
8¼"x10" Lidgerwood D. C. D. F. D. with boiler.

AIR COMPRESSORS
12"x10" Ingersoll-Rand Belted.
550 cu. ft. Ingersoll-Rand belted.

BOILERS
2—72" x 18' H.R.T. 140 lbs.
2—350 H.P. Heine water tube

Wm. C. Johnson & Sons Machinery Co.

1211 North 12th St. St. Louis, Mo.

REBUILT EQUIPMENT

1—No. 4½ Champion Jaw Crusher. Price, $750.00.

1—9x15 Blake Jaw Crusher. Price, $650.00.

1—No. 3 McCully Gyratory Crusher. Price, $750.00.

THE DAY & MADDOCK COMPANY
West 82nd St., South of Denison Ave.
CLEVELAND, OHIO

AIR COMPRESSORS

92 ft. Ingersoll-Rand, ER-1, Belted.
355 ft. Ingersoll-Rand, ER-1, Belted.
355 ft. Ingersoll-Rand, FR-1, Steam.
528 ft. Ingersoll-Rand, ER-1, Belt.
599 ft. Ingersoll-Rand, Imperial XB-2, Belted.
888 ft. Ingersoll-Rand, Imperial XB-2, Belted.
1190 ft. Ingersoll-Rnad, Imperial XB-2, Belted.
1145 ft. Chicago Pneumatic OCB, Belt.
1400 ft. Chicago Pneumatic, OCB, Belt.
1500 ft. Ingersoll-Rand, Imperial XB-2, Belt.
1270 ft. Chicago, OCE Motor Driven, 3 phase, 25 cycle, 440 volt.
1308 ft. Chicago, OCE Motor Driven, 3 phase, 60 cycle, 2200 volt.
6—212 ft. Chicago Portable Oil Engine Driven Compressors.
Portable Gasoline Driven Compressors.

PITTSBURGH PNEUMATIC MACHINERY CO.
507 Liberty Ave., Pittsburgh, Penna.

Hyman-Michaels Co. Offers Another HOIST Bargain

Exceptional Purchase Places Nationally-Known Lidgerwood and American Hoists on the Market

Less than one-quarter the regular price—that is our offer on these hoists. We bought them at a big reduction from their real value, and to dispose of them quickly we will sell them at

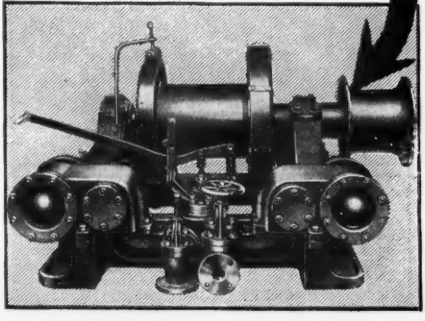
$195 Each, While They Last

Both the 7x12 Lidgerwood and 8¼x8 American Hoists offered here are of the Two-Cylinder, Single-Drum type, with reverse throttle, single geared; hoisting capacity 5,000 and 10,000 lbs. For hoisting and pulling in mines, construction work, etc.; for use on ships, tugs, barges; for skidding, swinging, car pulling, etc., these hoists are in constant demand. Our special bargain price while they last is only *$195.00 each, f. o. b. nearest shipping point.* These hoists will be loaded from Chicago or St. Louis.

We also own and offer complete stocks of New and Relaying Rails, First-Class Locomotives, Ballast Cars, and a full line of Flat, Box, Refrigerator and Steel Hopper Bottom Cars and Cabooses in excellent condition and at attractive prices.

Hyman-Michaels Co.

Peoples Gas Building, Chicago, Ill.
Railway Exchange Bldg., St. Louis, Mo.



HOISTS

Steam Electric and Gasoline

Sheaves—New metal bushed 11″ $5, 13″ $6, 16″ $7, 19″ $10.
Lathes—LeBlond Heavy duty 19″ x 8′ Q. C. $300.00 each.
Pumps—Brand new Scranton 6x5¾x6 $75.00 each.

MALLORY MACHINERY CORPORATION, Baltimore, Md.

FOR SALE
1—No. 7½ Austin Crusher, chilled iron fitted.
1—Model 60 Marion Shovel No. 1493.
1—Model 80 Marion Shovel No. 801.
1—Model 70 Bucyrus Steam Shovel.
1—Model "0" Thew Revolving Shovel.
1—1-yd. Vulcan Revolving Shovel.
THE CASPARIS STONE COMPANY
302 Yuster Bldg., Columbus, Ohio

ELECTRIC HOIST
with double tandem drums 30x30 & 18x20, with 100 H.P. 3 ph. 60 cycle, slip ring motor. Large repair shops, storage, trackage, immense stock used equipment.
HACKLEY MORRISON CO.
1708-1722 Lewis St., Richmond, Va.

CRUSHERS
1—No. 4½ Champion jaw, manganese jaws, almost new, special bargain, 100 car loads dependable used machinery in stock.
HACKLEY MORRISON
Richmond, Va.

LOCOMOTIVES
1—Standard Gauge, 36-Ton Steam Locomotive.
THE POLLAK STEEL COMPANY
Cincinnati, Ohio

For Sale
10 Ingersoll-Rand X-70
Rock Drills
50% of new price
ARCHER ARMSTRONG, INC.
Grand Central Terminal Bldg.
New York City

BOILERS
3-200 H.P. Scotch boilers, 160 lb. pressure, corrugated furnaces, portable, economical, no brick setting needed. Large stock used equipment. Cars, rail, crushers, locomotives, pipe, screens, hoists, etc.
HACKLEY MORRISON CO.
1708-1722 Lewis St., Richmond, Va.

FOR SALE
1—Marion Dragline No. 28 with three-quarter yd. bucket. Complete with tank wagon, cable and jack. Machine is in good condition and can be inspected at any time at our plant. Shop No. 3856.
SIBLEY CEMENT CO., Sibley, Ia.

T. H. LETSON CO.
Good Used Equipment — Hudson Terminal Bldg. NEW YORK — Clean Business Methods

CRUSHERS
1—No. 3 Austin with elevator and screen. Used 4 months, practically new. Bargain. $1,000.00.
1—No. 6 Austin—practically new. Used 9 mos. in soft limestone. Bargain. $2,000.00.
10-TON HOLT TRACTOR
Used 214 days. First class condition. $2,000.
M. WENZEL,
3514 Agnes Ave. Kansas City, Mo.

FOR SALE
4—Sturtevant Ring Roll Mills
For further particulars address
NATIONAL CEMENT CO.
Ragland, Ala.

FOR SALE
1—18B Bucyrus Shovel, on traction wheels. Shop No. 2053.
1—No. 20 Superior Type McCully Crusher. Located Olive Branch, Ill.
Both like new.
H. A. COOLEY
3411 S. Oakley Ave., Chicago, Ill.

CRANES
3—5-Ton 220V, 3 Motor, 26′ span traveling cranes. 1,700 Ft. Crane Runway Girders.
THE POLLAK STEEL COMPANY
Cincinnati, O.

1—I-R Compressor—1190 ft.—Belt Dr.
4—36 in. Gage Electric Locomotives.
1—Byers "BEAR CAT" Crane.
1—Thew Shovel ¾ yd. Cat. Tr.
2—4 Drum McMyler Shaft Hoists.
1—7E Dake Hoist, 30 H.P.
5—12 yd. Std. Gage Dump Cars.
5—4 yd., 36 in. Gage Dump Cars
1—10 Ton Buffalo—Springfield Roller
1—3½ Ton Tandem Roller
18 in. and 24 in. Conveyor Belt and Idlers.
2—28-S Ransome Concrete Mixers.
1—Tank Wagon.
12 in. and 14 in. Centrifugal Pumps.
1—Marion 21 Shovel ¾ yd. Cat. Tr.
Derricks, 2 and 3 Drum Hoists.

J. T. WALSH
500 Brisbane Bldg., Buffalo, N. Y.

CRANES
McMyler, 25 ton 8 wheel, 50-70 ft. Boom.
Browning, 15-20 ton, 8-wheel, 50 ft. Boom.
Byers Model 10, Gas. Cat. ¾ yd. Bucket.
O. & S. 12 ton, Gas. Cat. 1 yd. Bucket.
SHOVELS AND DRAGLINES
Bucyrus 175B, 3½ yd. Dipper, A-1.
Marion 76 R. R. type 3½ yd. Dipper.
Bucyrus, 20 B, Cat. High Lift.
Bucyrus 14B Cat., ¾ yd.
Marion 36 Cat. high lift 1¼ yd.
Bucyrus 14 Dragline, 60 ft. Boom, Caterp.
Marion 21 Dragline Caterp. ¾ yd.
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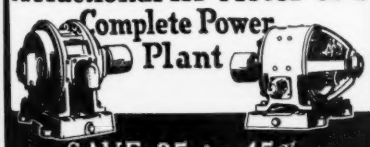

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